1 HOUR WORKSHOP: 10 EASY-TO-BUILD BENCH ACCESSORIES

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Vol. 27 / No. 162

BEST BITS for a Flush Fit

FAST FIXES for Scrapes and Scratches

QUICK & EASY Table Saw Project

turn to p. 16

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looking inside

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Serving Tray 16

You'll be serving guests in the evening after spending the day building this stylish tray.

DESIGNER'S NOTEBOOK

designer series project

Woodsmith GO ONLINE EXTRAS

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With its simple, divided bin, this chest provides the solution to a wide range of storage needs.

DESIGNER'S NOTEBOOK

heirloom project

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With classic styling and commanding presence, this grandfather clock is sure to be a "timeless" heirloom classic for years to come.

DESIGNER'S NOTEBOOK

ONLINE EXTRA
video workshop

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These two symbols let you know there's more information online at www.Woodsmith.com. There you'll see step-by-step videos, technique and project animation, bonus cutting diagrams, and a lot more.

Grandfather Clock page 30

editor's note

Sawdust

We do our best to feature a collection of great projects in each issue. Our hope is we'll inspire you to build at least one of them. But with the collection of projects in this issue, I wouldn't be surprised if you're tempted to try your hand at building all three.

Take the serving tray for example. It's a simple weekend project that you can easily customize — simply vary the materials for the different parts of the tray. And speaking of customizing, the tilt-out storage chest is another project that not only solves your storage needs, but can be built to match whatever room it's located in.

Last but not least, there's the grandfather clock. This is the kind of project every woodworker dreams of building. Truly an heirloom piece to be handed down for generations to come. Turn to page 30 and you can get started on your own timeless classic.

NEW FACE. Featuring great articles and projects in each and every issue of *Woodsmith* requires a talented group of people. To help us out with all this, Randy Maxey recently joined our staff as an assistant editor. We're all looking forward to working with him.

Terry

STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION
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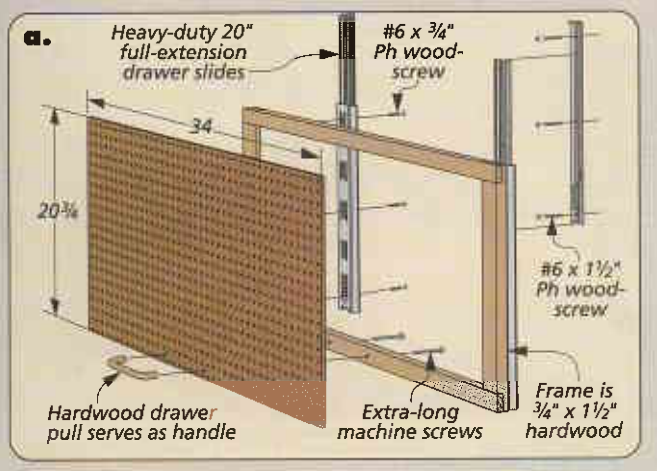
Tips & Techniques

▲ To hold the panel up, insert a dowel pin into a hole in the center stud. A chain is attached to the pin to keep it handy.

Sliding Pegboard Storage

I have a very small shop in my basement, and every nook and cranny is filled with tools, lumber, and other items. The studs in the walls are exposed, so I added scrap pieces of 2x4 between the studs to act as small shelves. But to get even more storage space, I came up with the sliding pegboard panel you see pictured above.



The first thing was to build a frame for the pegboard to span across three studs (drawing at left). The frame will add rigidity to the pegboard, making it stronger. Then I installed a handle on the panel, which will make the panel easier to slide up and down.

With the panel complete, it was time to mount the heavy-duty drawer slides vertically onto the studs. You'll need to take the slides apart so you can mount one part to the studs and the other part to the pegboard panel.

As you can see in the main photo above, the slides are mounted on the exposed edges of the studs. This way, they don't take up the valuable storage space between the studs. For a stronger connection to the studs, I used longer screws than the short screws that typically come with a set of drawer slides.

Just before you put the slides back together, it's a good idea to plan for supporting the panel in the open and closed positions.

To hold the panel in the open position, there's a dowel with a metal pin that slips into a hole I drilled in the center stud. To keep from losing the dowel, I attached it to a chain mounted to one side of the center stud (see inset photo at far left). Then, to relieve the pressure on the drawer slides in the closed position, simply install a lag screw in the center stud.

Once that's done, put the slides together and move the panel up and down to make sure the slides don't bind. With a few hooks and other pegboard hardware, this sliding panel gives me extra storage and still allows access to the shelves behind it.

Josh Steinberg
Boerne, Texas

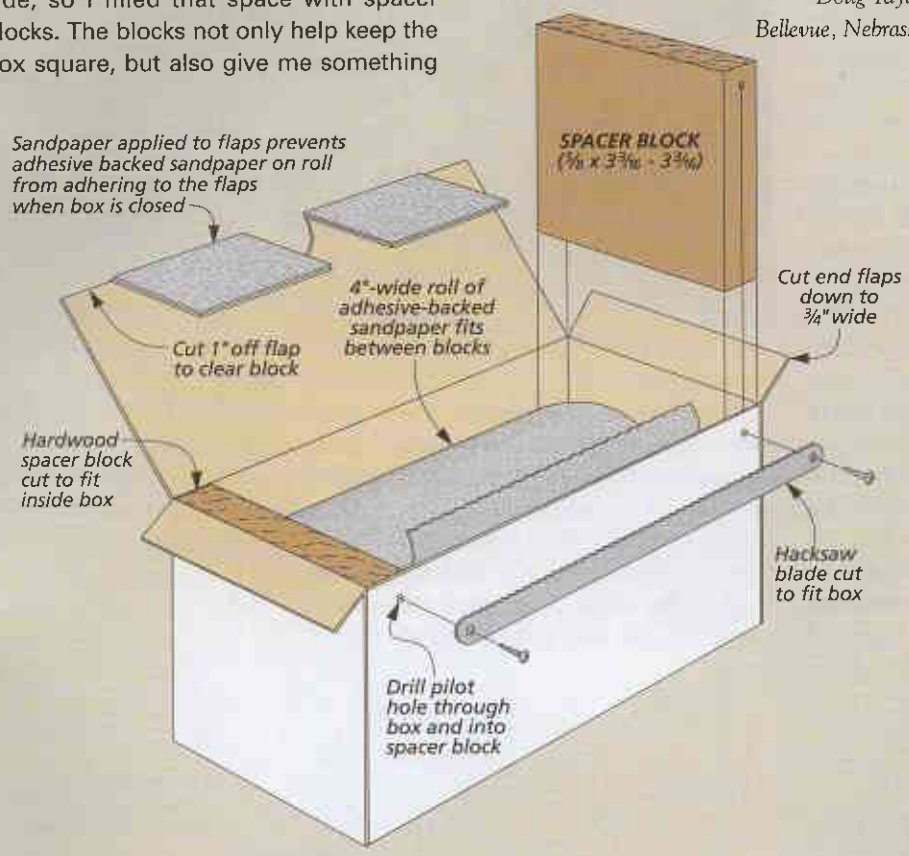
Sandpaper Roll Sheet Cutter Box

When I buy sandpaper, I get it in rolls rather than sheets because it's a little cheaper that way. But cutting it off the roll can be difficult, especially with adhesive-backed sandpaper. To solve this problem, I made some modifications to the sandpaper's box (see drawing below).

The box had some extra space on each side, so I filled that space with spacer blocks. The blocks not only help keep the box square, but also give me something to attach an old hacksaw blade that will be used to cut the sandpaper. I cut the blade to fit the width of the box. Next, sandpaper is applied to the inside flap so the backing wouldn't stick to the box.

Now, I simply pull out the amount of sandpaper I need and cut it from the roll quickly and easily.

Doug Taylor
Bellevue, Nebraska



Shelf Brackets for Squaring Large Assemblies

Gluing large pieces of a project together and keeping them at right angles to each other can be a real chore. To solve this problem, I use shop-style, steel shelf brackets that you can buy at any hardware store or home improvement center.

These brackets are flat, so they can be easily clamped to the surfaces of the project. They're strong enough to hold almost any large assembly square.

And, another great thing is that the brackets already have holes in them. So if you need to add spacer blocks (like you see in the photo at the right), all you have to do is simply screw a scrap piece of plywood to the bracket and then clamp it down and wait for the glue to dry.

Jim Hancock
San Rafael, California

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Drill Press Vacuum Tray

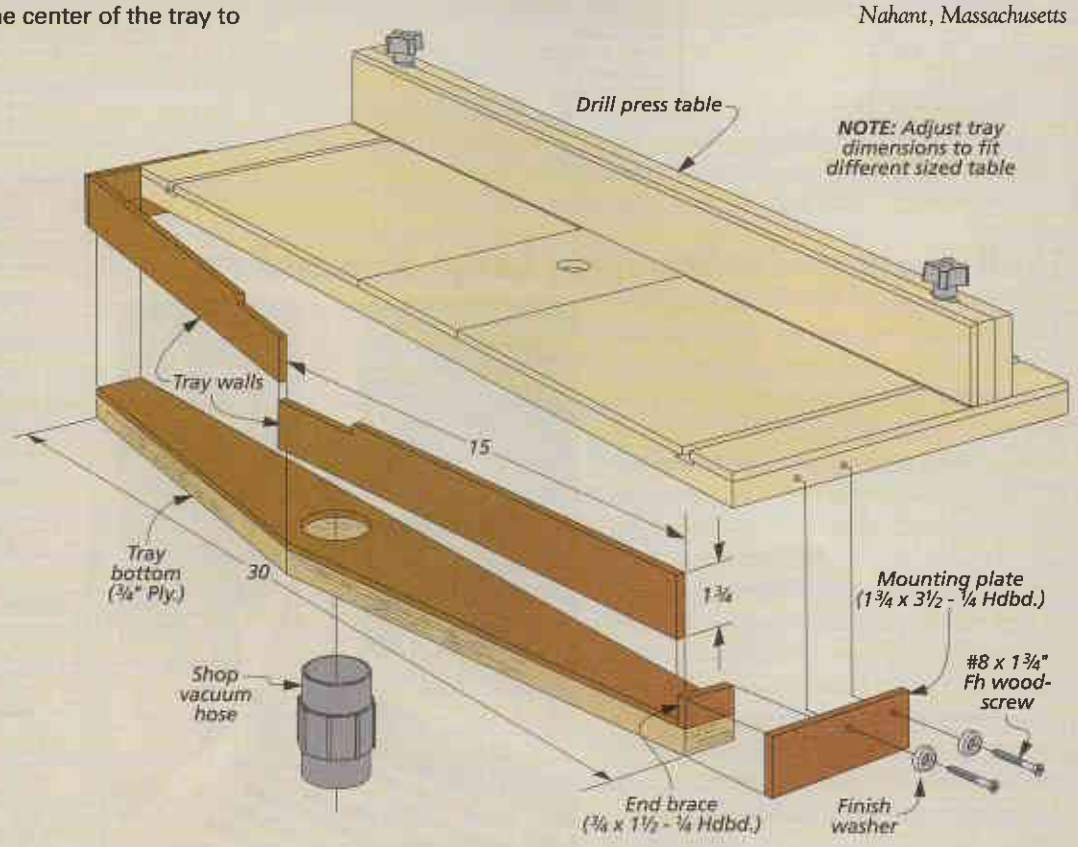
I built an auxiliary table for my drill press and have found it to be very useful. But whenever I drill a lot of holes, I find the table overwhelmed with wood chips and sawdust. That means having to stop frequently and sweep the debris off the table. So, to solve this problem, I made a chip-collection tray to fit my auxiliary table, like you see in the photo at right.

The tray is made up of ¼" hardboard glued on top of ¾" plywood that will serve as the tray's base. Then you can cut the tray according to the drawing below, making any necessary adjustments to the dimensions so the tray can fit any sized table. You can see that the tray extends the full width of the auxiliary table and attaches on both ends. Since most of the sawdust and wood chips accumulate at the center of the table, there's a hole cut in the center of the tray to fit the hose of a shop vacuum. The tray is tapered toward each end to reduce the distance that the corners extend into my shop.

The top edges of the tray's hardboard walls line up with the top edge of the table. A notch at the center of the tray allows me to remove the insert of the drill press table when needed.

Now, when drilling a bunch of holes, a periodic sweep with my hand puts the debris into the tray and out of the way. Plus, there's no mess on the floor.

Don Warner
Nahant, Massachusetts



SUBMIT YOUR TIPS

If you have an original shop tip, we would like to hear from you and consider publishing your tip in one or more of our publications. Just write down your tip and mail it to: *Woodsmith,* Tips and Techniques, 2200 Grand Avenue, Des Moines, Iowa 50312. Please include your name, address, and daytime phone number in case we have any questions. If you would like, FAX it to us at 515-282-6741 or send us an email message at: woodsmith@woodsmith.com. We will pay up to $200 if we publish your tip.

Trash Can Dust Collection

Over time and a lot of emptying, the bottom bags of my dust collector just wore out. So I went looking for a more sturdy solution that would also make it easier to empty the sawdust.

My answer is what you see illustrated below. I found a couple of heavy-plastic garbage cans with openings that matched the openings in the blower housing of my dust collector. "Windows" are cut near the top of the cans so you can tell when the cans are getting full. Inside each can is a transparent garbage bag (so you can see the sawdust through the window). The best way to clamp the bags to the housing is by using ratcheted hold-down straps, which are easier to use than bungee cords.

Now, whenever I need to empty the sawdust, all I have to do is unlatch the straps, slide the cans out from under my dust collector, and tie off the bags. There are no more ripped bags, and replacing the bags is a snap.

Dick Norberg
New Hope, Minnesota

Quick Tips

GETTING STAIN OUT OF CORNERS

Getting the right amount of stain into the corners of a project can be difficult, but getting excess stain out of the corners is even more so. Instead of jamming a shop rag into the corner, I use a dry, natural-bristle brush. It works very well to "pull" excess stain out. Keep the bristles dry by brushing out the removed stain on a piece of cardboard or other clean surface.

Carl Towe
Asheville, North Carolina

STICK-ON MEASURING TAPES

I'm always forgetting where I put my tape measure, wasting time trying to find it. My solution was to put several adhesive-backed measuring tapes around my shop, including my workbench, my table saw rip fence, one next to where I store my wood, and another one on shop cabinet doors. Now, I always know where I can make a quick measurement.

Chris Fitch
Winterset, Iowa

OUTLINING AN INLAY

When inlaying a complicated shape, a light coating of spray-paint will give a dead-on accurate outline. Once your finished with the inlay, a light sanding is all it takes to remove the paint.

Ron Freeman
Melbourne, Florida

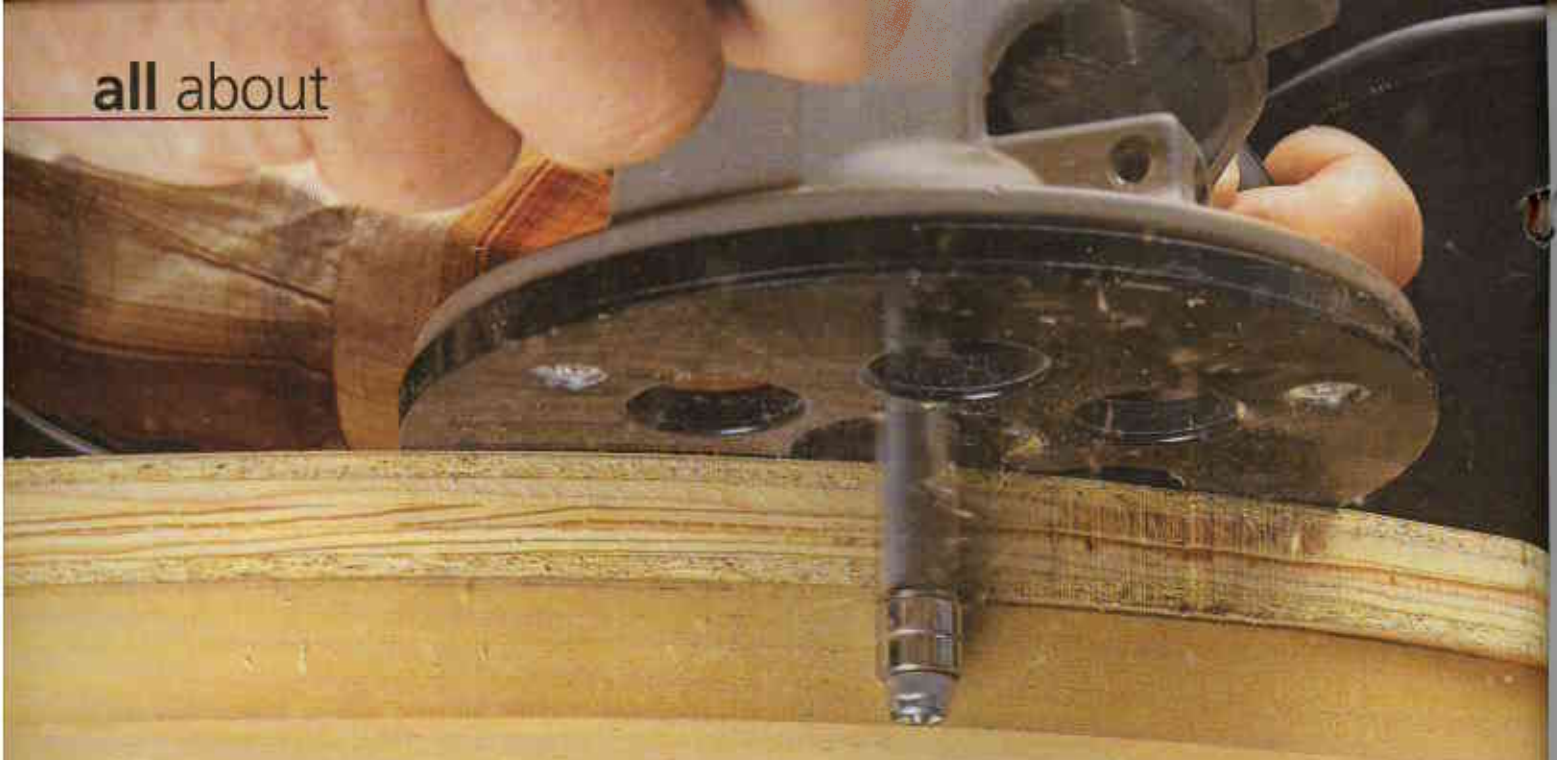
Win This Porter-Cable Variable Speed Router

That's right, send us your shop tips. If your tip or technique is selected as the featured reader's tip, you'll win a Porter-Cable variable speed router just like the one shown here. Send your tips and techniques to: *Woodsmith,* Tips and Techniques, 2200 Grand Avenue, Des Moines, Iowa 50312. Or send us an email message at: woodsmith@woodsmith.com.

The Winner!

Congratulations to Josh Steinberg of Boerne, Texas. His sliding pegboard panel was selected as the winner of the Porter-Cable router. The pegboard maximizes the storage space of a shop wall that has exposed studs.

To find out how you could win a Porter-Cable variable speed router, check out the information on the left.



choosing the Best Bit for a Flush Fit

It's all in the angles. Find out how the design of a flush-trim bit can help you get the best results. It's all about the cutting edge.

No workshop should be without at least one flush-trim bit. It sounds like a bold statement, but I use this type of bit often for routing tasks like shaping parts from a template, or trimming hardwood edging, and even jointing the edges of a workpiece.

But I haven't always been satisfied with the results I get from a regular flush-trim bit. Especially when routing plywood. I've learned that this old standby may not be the best bet for a flush fit. There are a couple other alternatives that promise better results.

NEWER CHOICES. Traditional flush-trim bits are essentially ordinary straight bits with a bearing on the end of the bit. The bearing follows a template, or pattern, as shown in the photo above. The cutting edges on these bits run straight up and down. And for the longest time, this used to be the only option.

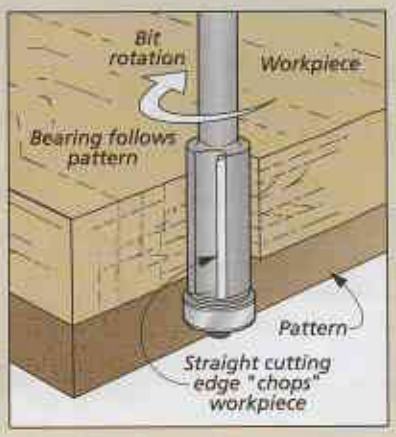
Now, however, you have a choice. Newer bits are available that put a different angle on flush-trimming. Some bits use a slightly angled (or shear) cutting edge while others are made of solid carbide with spiral cutting edges. You can see these two types on the opposite page.

THE CUTTING EDGE. I wanted to find out what the real difference is between these three cutting edges. Does a spiral bit create a much smoother finish? I also wanted to see if a down-shear bit was better than a traditional straight bit.

I tested each type of bit on some plywood. What I was looking at was the quality of the routed edge and the amount of tearout along the top and bottom edges.

Traditional Flush-Trim Bit

A straight bit has more of a "chopping" action, leaving some whiskers on both the top and bottom edges and a rougher edge



PREVENTING TEAROUT

I discovered that all three bits do a good job routing the edges of the plywood. But I noticed that the straight and shear bits caused more tearout than the spiral bit.

CROSS-GRAIN TEAROUT. The biggest difference showed up when routing across the grain. The straight bit created chipout on both the top and bottom edges (photo on the bottom of the opposite page). To see why, take a look at the drawing next to the photo. Since the whole cutting edge of the bit hits the piece at once, it creates a "chopping" effect that's hard on the bit and leaves ripples in the edge of the workpiece.

SMOOTH TOP EDGE. The down-shear bit showed less tearout (photo below). And the drawing below shows the reason. First, the angled cutting edge creates a smoother cutting action. And second, because of the downward cutting angle, the top veneer fibers are fully supported.

THE CLEANEST CUT. The solid-carbide bit gave the smoothest finish. The workpiece didn't require much, if any, sanding. The spiral edge creates more of a *slicing* action on the wood fibers than the traditional bits.

You can buy spiral bits in an "up-shear" or "down-shear" version. In other words, as the bit rotates, it's essentially cutting the wood fibers up towards the router or away from the router. The drawing at the right shows a down-shear bit.

One thing to be aware of with spiral bits is that you may still get some tearout. But that depends on whether it's an up-shear or down-shear bit. The edge of the workpiece opposite the cutting direction of the bit should be supported as in the drawing on the right.

A BIT OF ADVICE

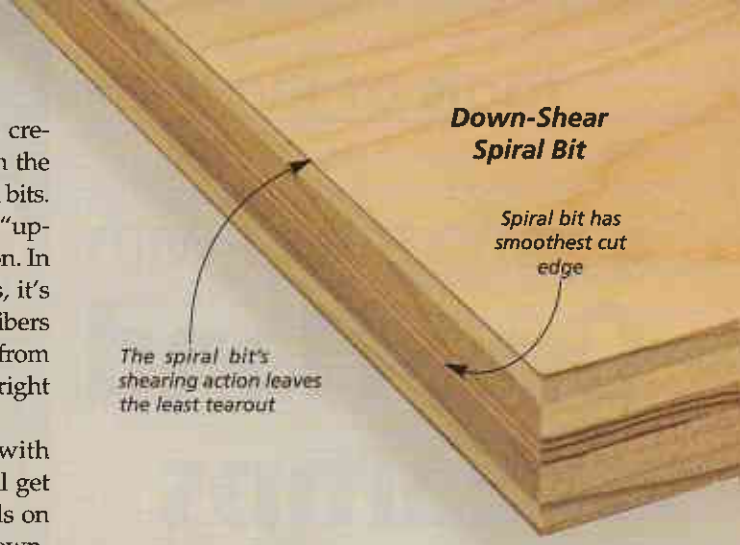
After using these bits for awhile, I found out that the best bit for a flush fit depends on the task at hand.

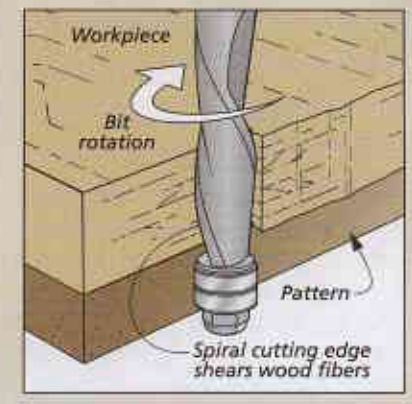
HARDWOOD ROUTING. For flush-trim routing in hardwood, a sharp flush-trim bit with a traditional, straight edge is tough to beat. If you do use this type of bit in plywood, be sure to take light passes and be prepared to do some sanding. What's nice is that these bits don't cost a whole lot.

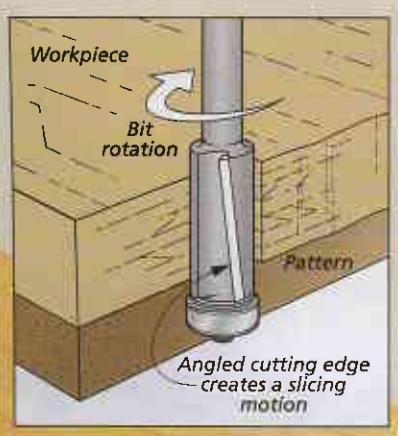
BEST OF BOTH WORLDS. The down-shear bit offers an improvement over the traditional bit when routing plywood. And since they cost about the same, this is a good bit to have on hand for getting smooth cuts in both hardwood and plywood.

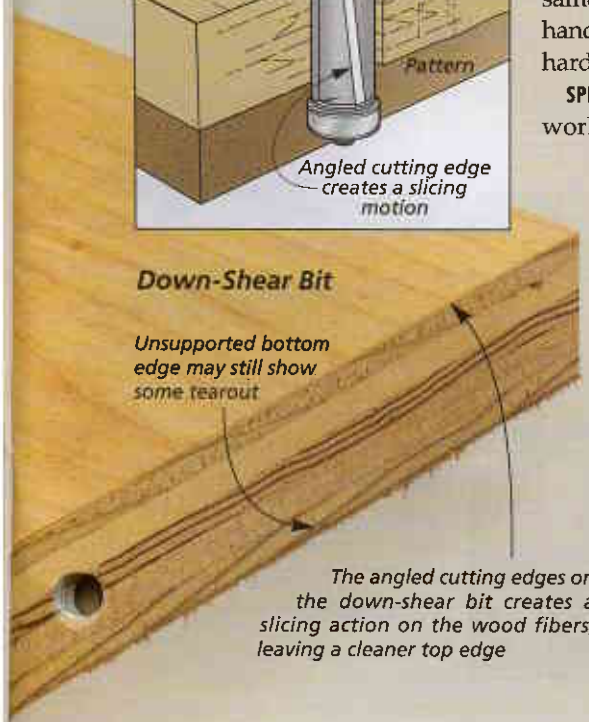
SPIRAL ADVANTAGE. If you do a lot of work with plywood and need the smoothest edge, there's no question the spiral bit is the best choice. If there is a downside, to these bits, it's the price. Spiral bits can cost up to five times more than other flush-trim bits. But the smooth cutting action and solid carbide construction means they last much longer.

I turn to a flush-trim bit every time I need to get a flush, seamless fit for plywood or hardwood. And choosing the best bit to use always makes the job quicker and easier. W





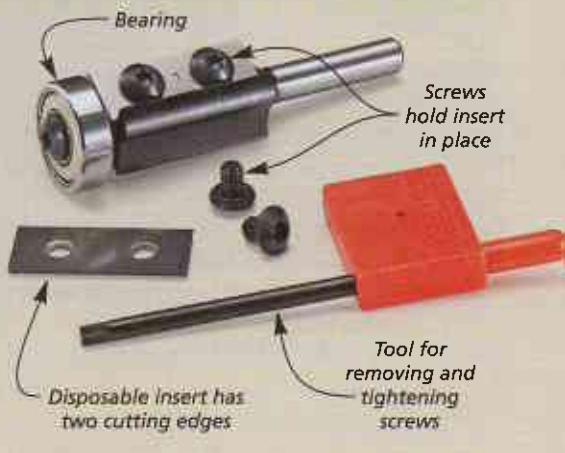




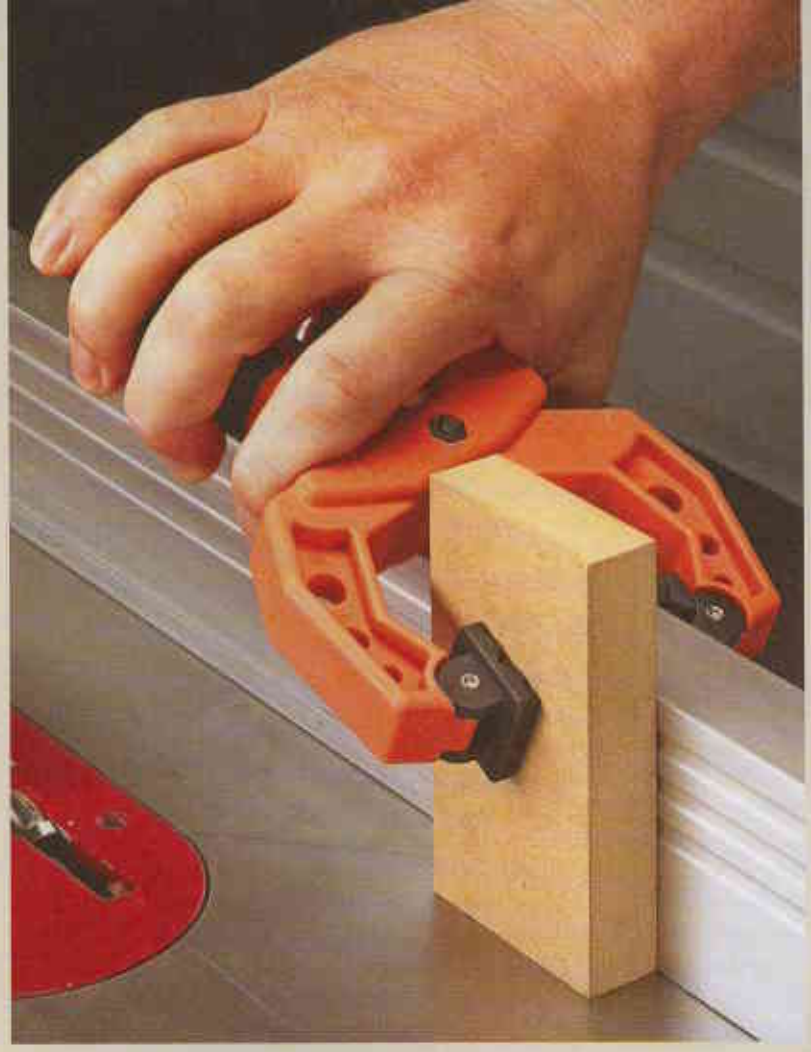
Worth a Look: Cutter Inserts

Replaceable cutter bits have been in the metalworking industry for many years. The reason is it's cheaper to simply replace the cutting edge than get a new bit.

Woodworkers are now able to take advantage of them. While these bits initially cost more, you get the benefit of multiple cutting edges on each cutter insert. When one edge gets dull, simply remove it and flip it over for a fresh cutting edge.



getting a grip with **One-Hand Clamps**



Applying clamps is one of those things that usually takes both hands and a little time. But when it comes to clamping a jig to your bench or temporarily securing a stop block in place, like you see in the photo at right, one-hand clamps are the fastest clamps around.

They work like a set of pliers, applying pressure through the jaws to hold the workpiece in place. And once in place they hold the piece securely and safely in position.

These clamps are easy to find (see page 49 for sources). And best of all, they're some of the least expensive clamps you'll ever buy.

Standard Spring Clamps

▲ The least expensive of the one-hand clamps is the simple spring clamp. Just squeeze the handles to open the jaw and slip it over the workpiece. Then release the jaws to hold the workpiece firmly in place. You'll find spring clamps available in a variety of sizes. They're fast to apply and just as quick and easy to remove.

◄ The *Pony Adjust-a-Clamp* gives you the ability to adjust the amount of clamping pressure of the jaws. A turn of the adjustment screw inside the handle, as shown in the photo at left, changes the clamping force from 1 to 50 lbs.

Ratchet-Lock Clamps

◄ The ratcheting mechanism of the *Irwin Quick Grip Hand-Clamp* allows incremental pressure adjustment as you squeeze the handles together. A trigger next to the handle (see photo below) quickly releases the clamp for fast removal or easy repositioning.

This beefy *Professional Diamond* clamp from *Craftsman* has a metal ratchet adjustment and metal jaws. Firm pressure on the handle button is required to open the jaws. ▼

▲ Removable plastic pads fit over the tips of the jaws. So all you need to do to get a firm grip on metal objects is quickly slip them off.

The *Pony Pressure Adjusting Clamp* uses a steel rod that locks up automatically as soon as you stop applying pressure. A light touch of the release lever quickly loosens its grip. The pivoting tips and wide jaws make them ideal for use on irregular shapes. ►

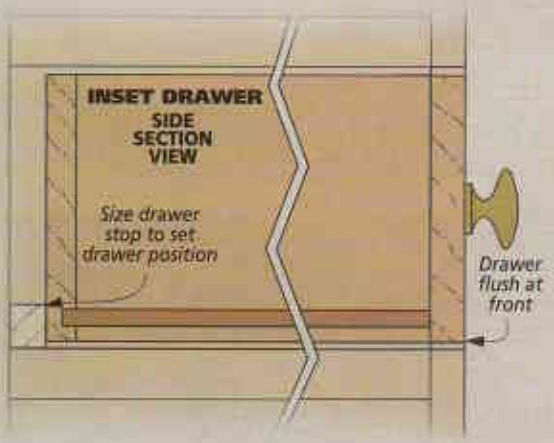
▲ The *Craftsman Variable Ratchet Clamp* has an adjustable ratchet located on one the side of the grip (see photo at right). Longer handles allow you to exert more jaw pressure.

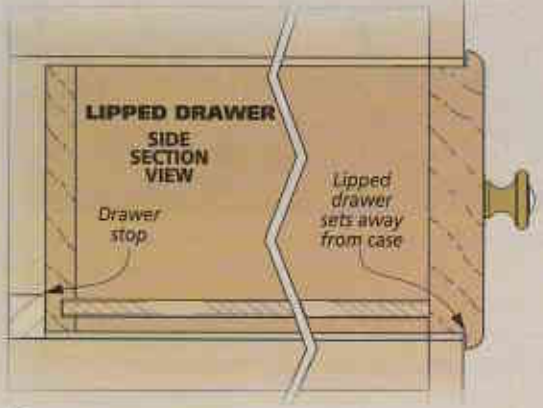
Adjustable Jaw Position

▲ If a wide range of jaw openings is what you need, the *Bessey Varioclippix* clamp is the one to use. The top jaw slides open easily with one hand and the notched handle controls the pressure. Soft pivoting pads protect and secure the workpiece.

designing and using Drawer Stops

Sometimes it's the details you don't see that really make a difference. Check out these classic solutions for top-notch results.





After spending a lot of time fitting a drawer into its opening, you realize there's one more piece of the puzzle. What's going to keep this drawer in the proper position when it's closed? And, what's going to keep the drawer or case from damage if the drawer is closed too hard? The answer — drawer stops.

When you think about it, drawer stops act like a car bumper. They spread out the force of the drawer closing over a larger area, preventing other parts of the case from being damaged or working loose.

DESIGNING FOR DRAWER STOPS. At first glance, it's hard to imagine how drawer stops can serve as a design element. But they determine where the drawer face stops in relation to the front of the case. This can affect the overall look of your project.

No matter how careful you are at measuring and trimming, it can be a challenge to get drawers to fit just right. Either they end up setting too proud or slip too far in the case. Rather than try to build my drawers the exact depth of the opening, I undersize the drawers a bit and use drawer stops to fine-tune the fit (upper drawing at left). Regardless of what type of drawer construction you use, a stop can control how the drawer will rest when it's closed.

FORCE OF IMPACT. One thing I think about when designing a project is how it will stand up to every day use — and abuse. Regardless of the size of the drawers, you have to consider what might happen if the drawers are slammed shut or are heavily loaded, or get a lot of use.

Without drawer stops, the force of impact when closing a drawer can be significant and can, over time, loosen case joints.

For example, in the lower drawing at left, the fragile lip on the drawer front may break off after repeated slamming. To prevent this from happening, I'll adjust the back stop so that the drawer front stops just short of touching the case.

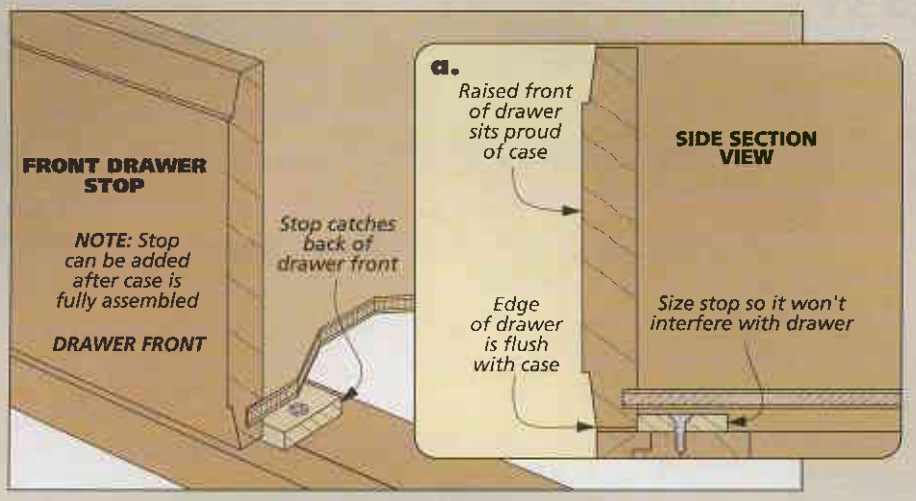
DRAWER STOP PLACEMENT

While you're designing and building a project, you have a couple of options for the placement of drawer stops. The most common positions are either at the back of the case or just behind the drawer front.

BACK STOPS. I've found that the best location for drawer stops is usually at the back of the case. Stops located here don't stress the drawer joints. You can see this in the drawings on the opposite page.

There are a couple of things to consider when designing for stops at the rear of the case. For one, you may need to leave the back of the case off to adjust and install them. And second, you'll lose some drawer space to make room for installing the stop in the case.

FRONT STOPS. On the other hand, installing drawer stops at the front of the case can be done after the case is fully assembled. And it allows for full-depth drawers. You just need to size them so that the stop does not interfere with the drawer.



In the drawing above, you can see an example of what I'm talking about. Here, a thin drawer stop is screwed to the front of the case. It's sized so that it will bump against the back of the drawer front.

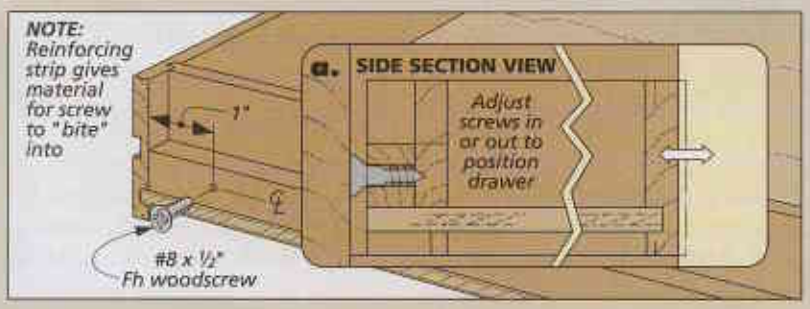
There are a couple things to consider. The first is that the stops have to be pretty thin so they don't interfere with the drawer. And second, it places a lot of stress on the joints at the front of the drawer.

CREATIVE SOLUTIONS

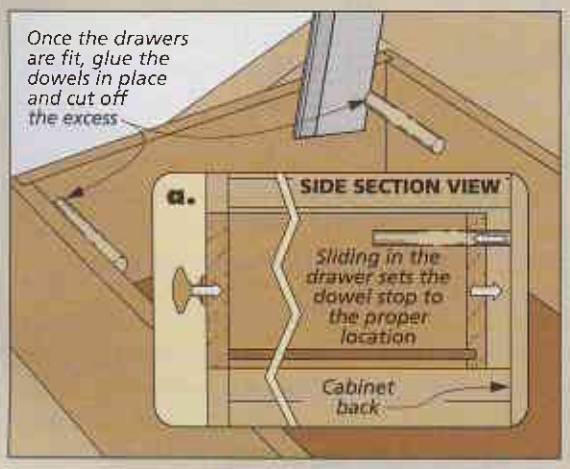
One thing I like about woodworking is that I get to learn some tricks from others. So, I've picked up a few drawer stop solutions that have come in handy for me.

One simple solution for small drawers uses screws as stops (left drawing). A reinforcing strip is added to the back of the drawer. Then I put a wood screw on each end of the drawer back. To adjust the fit, you just turn the screw in or out. It's simple and effective.

Another type of drawer stop that works in a similar way uses dowels. In this case, the dowels can either serve as stops themselves, or they can be used as a "gauge" to determine the proper size of a drawer stop. For more details, take a look at the box below. W



Shop Tip: A Quick Stop With A Dowel



Here's a quick way to incorporate a drawer stop in drawers. A couple of dowels protrude from the back of the drawer to properly position the drawer when closed (detail 'a' at left).

You can also use this method as a handy means for determining the size of a stop block you want to glue in place. Instead of gluing the dowel in place, you simply measure the length of the dowel that protrudes from the back of the drawer. Then, it's just a matter of cutting a stop block to the same depth and gluing it in place.

▲ To fix the dowel in place, simply apply a little glue to the hole. When the glue is dry, you can cut the dowel flush.

a closer look at the Miller Dowel System

Easy to use and surprisingly strong, this new dowel system may just change the way you think about dowel joinery.

The System. *Miller dowels and bits are available in three different sizes for working with stock from ½" to 1⅝" in thickness.*

I'll admit it. I've never been a very big fan of dowel joints. Trying to line up the holes for the dowels is always difficult. And sometimes, the dowels swell up when you apply glue, making it almost impossible to drive them into the holes. On top of all this, dowels may not be the strongest choice. So when I first heard about a "new" type of dowel, I was a little skeptical. Okay — really skeptical.

But after trying out the *Miller Dowel System*, I have to admit that I was pleasantly surprised. The dowels were easy to use and install. But what impressed me the most was the holding power of these dowels. They work so well that I couldn't pull apart the test pieces that I joined with the dowels — and that was without using any glue.

TAPERED DOWELS. If you take a look at the photo at left, the first thing you'll notice is that *Miller* dowels don't look anything like the straight-sided dowels you're probably used to seeing. Instead, these dowels are "stepped." Each step is slightly smaller in diameter than the previous one, creating a "tapered" dowel. This makes installing the dowels much easier, since they can be pushed into place by hand and then seated with just a couple of blows from a mallet or hammer.

But the dowels are only one half of the equation. In order to drill matching holes for the dowels, you'll also need a special, stepped drill bit. (*The Miller Dowel Company* calls this their *Tru-Fit* bit.) Together, the drill bit and the dowels create a strong, tight-fitting dowel joint.

The stepped design of the dowels has another advantage besides making them easy to install. If you take a look at the lower drawing on the next page, you'll notice that the

top section of the dowel seats in its hole before the lower sections do. This allows the top section of the dowel to work like the head of a traditional, metal nail, pulling the two workpieces together. In fact, that's a good way to describe how *Miller* dowels work — like big, wood nails.

SIZES. *Miller* dowels are available in three different sizes for working with different thicknesses of stock. And the dowels are also designed so that you can cut off the tip to create an even shorter dowel.

Miller dowels also come in four different domestic species of wood — red oak, cherry, walnut, and birch. And recently, the company has introduced a line of dowels made out of weather-resistant woods. (See box below, for more details).

USING MILLER DOWELS. Using *Miller* dowels is pretty easy. Start by clamping the two workpieces you wish to join together. Then using the appropriate size of stepped drill bit, drill a pilot hole for each dowel, as you see in Step 1 above.

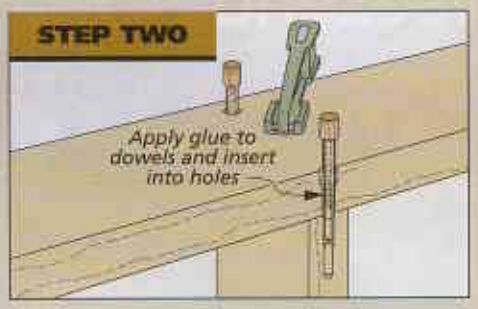
To install the dowel, just apply some glue and then press the dowel into the hole by hand (Step 2). The design of the dowel and hole will allow you to push the dowel almost all the way in. Then to seat the dowel, just give it a couple of taps with a hammer or mallet (Step 3).

With the dowel driven in place, the last step is to trim it flush with the surface of the workpiece (Step 4). Then simply sand the end of the dowel smooth, if necessary.

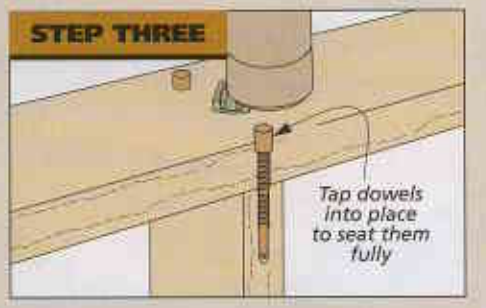
LIMITATIONS. Although *Miller* dowels work great, they aren't suitable for every application. For one thing, the dowels have to be installed through the outer face of a workpiece. So this means that you can't use them for applications like edge gluing. It also means that the heads of the dowels will be exposed. But depending on the project, this may not be a big deal. In fact, you might want to use the dowels as a visual element in the design of the project.

COST. *Miller* dowels range in price from $8 to $20 per pack, depending on the size and wood species. The small dowels are sold in packs of 100, while the two larger sizes are sold in packs of 40. The *Tru-Fit* bits sell for around $10 each. Or you can purchase a kit that contains a bit as well as a supply of dowels. For sources, turn to page 49. W

After clamping the workpieces together, drill the stepped holes to the appropriate depth to match the dowels.

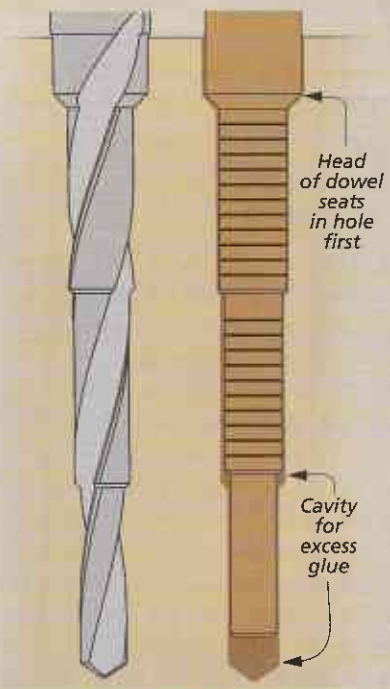


Next, apply a small amount of glue to the Miller dowel and press it into the hole as far as it will go by hand.



A few light blows from a hammer will fully seat the dowel in the hole and draw the two workpieces tightly together.

Once the glue sets up, you can trim the end of the dowel with a hand saw, then sand it flush with a sanding block.



Wood Nails. *The head of the Miller dowel seats before the rest of the dowel. This pulls the two workpieces together, like the head of a metal nail.*

Bigger Selection: All-Weather Dowels

Miller dowels are great for outdoor projects because they won't ever rust or stain the wood like metal fasteners can. In order to take advantage of this, the *Miller Dowel Company* has begun offering dowels in six different species of "weather-resistant" woods — ipe, black locust, purpleheart, teak, white oak, and mahogany. You can also use these dowels with contrasting woods as a decorative element.

elegant Serving Tray

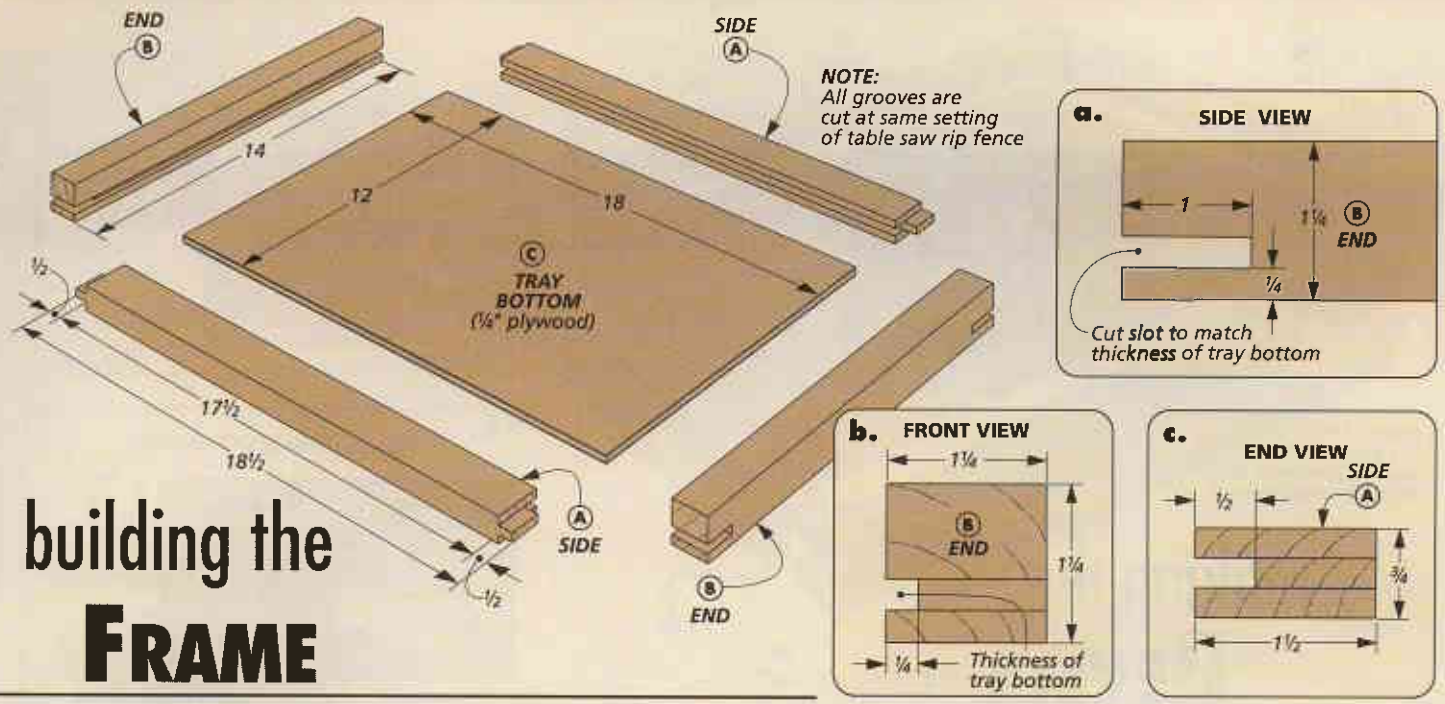
The simple design of this tray will have you serving your guests in short order. And the options for its look are many.

You don't have to build this serving tray with a wood bottom. Other materials, like the laminate above, can give it a distinctive look. See page 19 for more options.

Every once in a while, a project comes along that you can really put your mark on. A project that allows you to customize it any way you like. And an extra bonus would be that it's not hard to build either.

The serving tray shown here is just such a project. Sure, it's a stylish way to carry food and drinks from the kitchen to wherever you choose to relax. But by simply using different hardwoods for the frame and different materials for the bottom, you can change its look dramatically. Just look at the photo on the left.

But don't worry, all those choices don't mean the tray is hard to build. Everything from the bridle joinery in the corners, to the grooves that hold the bottom, to the raised handles on the sides can all be cut on the table saw — quickly and easily. And since the tray doesn't require a lot of material, this serving tray is the perfect project for those special scraps of hardwood you've been squirreling away over the years.



building the FRAME

The tray is nothing more than a hardwood frame surrounding a plywood panel. You'll make two side pieces and two end pieces, and then a groove in those parts to hold the bottom panel in place.

THE PARTS. As you get ready to cut the sides and the ends, you'll notice that the end pieces are thicker (taller) than the side pieces. This thickness allows for shaping of the ends to create the handle. To get those thick pieces, you'll need to cut the frame ends from 1¼" stock.

THE JOINERY. After cutting the frame parts to size, you're ready to start the joinery. The main drawing above shows that this bridle joint is a little different than most bridle joints. The short tongues are sized to fit into the slots of the *finished* handles (detail 'a'). The box below describes how I tackled the joinery.

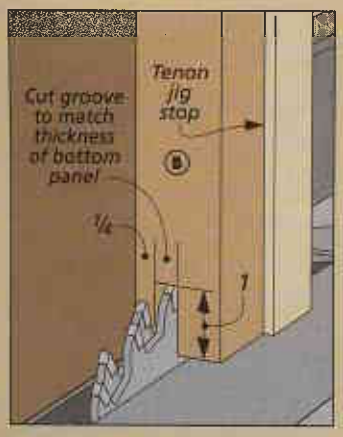
THE GROOVES. Before you cut the grooves, you need to know the panel's exact thickness. So, now is the time to decide what kind of bottom you want for the tray. For more information about some different tray bottoms, see page 19.

When you've decided on your bottom panel, cut the grooves to match the panel's thickness. The grooves in the sides (detail 'c') are deeper than the grooves in the ends (detail 'b'). This will give the tray's long sides some extra support.

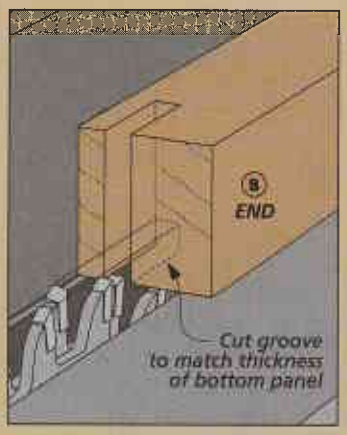
After cutting the grooves, the basic joinery is complete. Now you can dry-fit the parts to get the final dimensions for the bottom panel by measuring from the bottom of one groove to the bottom of the opposite groove. Then, it's just a matter of cutting the bottom to final size.

Next, you can set the bottom aside and turn your attention to shaping the side and end pieces.

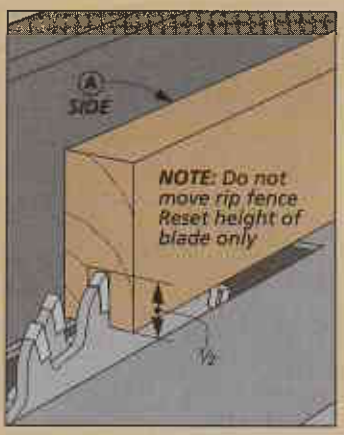
How-To: Bridle Joint



Cut the Slot. *The first step for the bridle joint is to cut the slot in the ends. A tenon jig will provide support for the workpiece.*

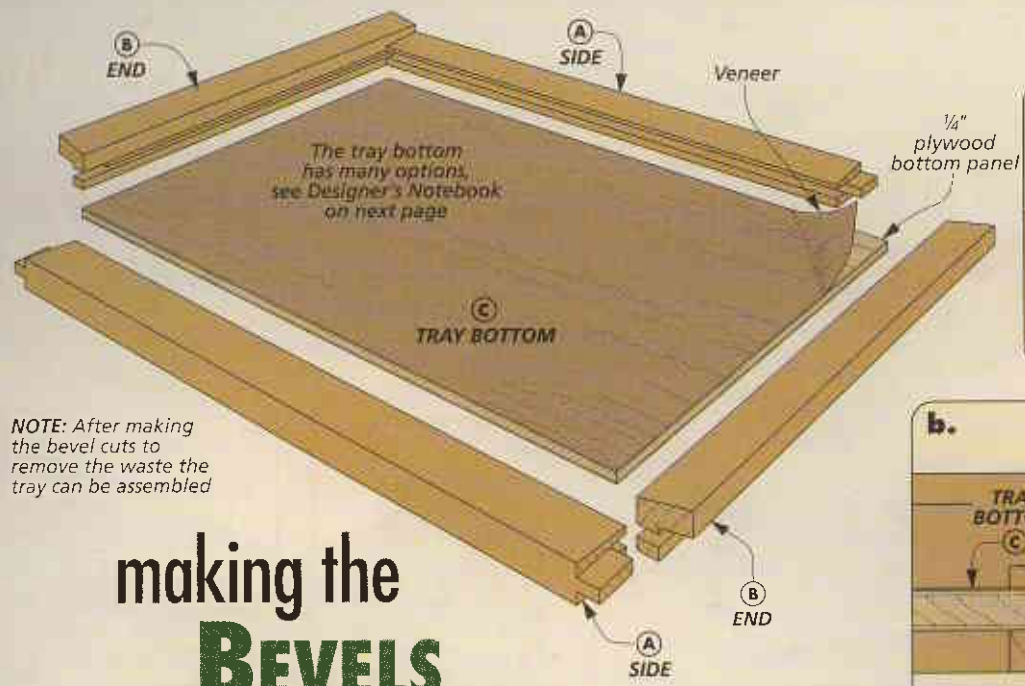


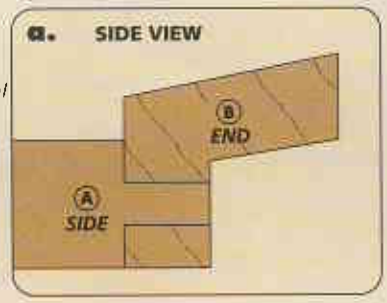
Grooves in Ends. *Leaving the fence in the same position, lower the blade and cut the grooves in the ends for the tray bottom.*

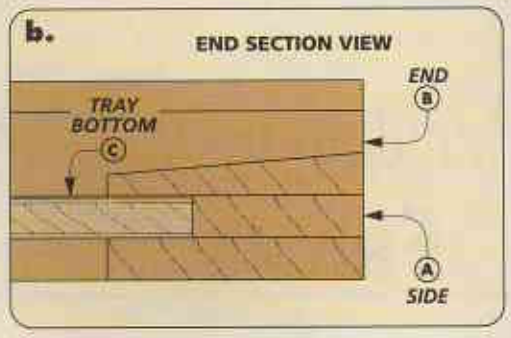


Grooves in Sides. *The side grooves are a little deeper, so you'll need to raise the dado blade before cutting them.*

Short Tongues. *The tongues in the sides are only ½" long to fit the final size of the slots in the finished handles.*







NOTE: After making the bevel cuts to remove the waste the tray can be assembled

making the BEVELS

Now that the joinery is complete, you're ready to cut the frame parts to their final shape and then assemble the tray.

The box at the bottom of this page and the following page shows how to cut the bevels in the side pieces and how to make the raised handles in the end pieces. There are some things to keep in mind while shaping those pieces.

SEQUENCE. First, pay attention to the order of the cuts in the box below. The goal is to keep the parts as stable as possible on your table saw as you make each cut. A push block made from a squared-up 2x4 scrap will provide some extra support for the cuts as well.

Next, the second drawing shows that the rip fence has been moved to the other side of the saw blade. This allows the waste to be cut away and not get trapped between the blade and the fence.

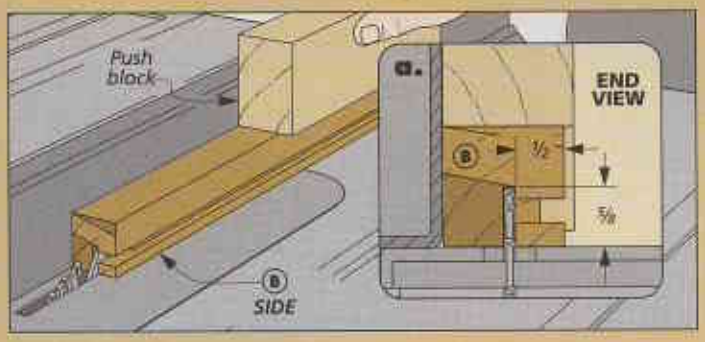
There are a couple of other things to watch for. The bevels are slightly different on the end and side pieces (see drawings on the following page). And as you get ready for each cut, be sure the part is positioned the right way, especially when working on the handles.

FINISH. If you choose a material other than plywood for the tray bottom, you may want to apply stain to the frame before the final assembly. That way you won't have to worry about trying to keep stain off the panel. And you'll want to keep the finish off the joinery so it won't interfere with the glueup.

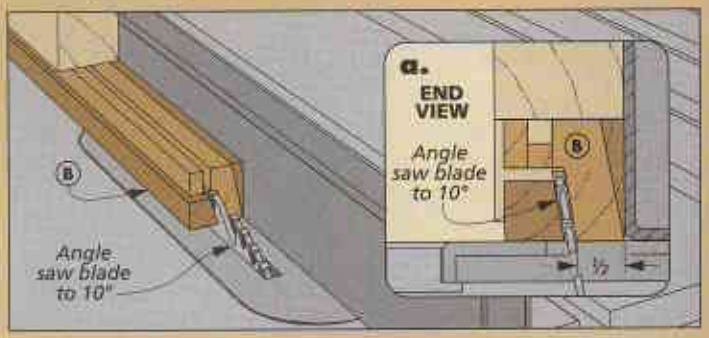
ASSEMBLY. Now, it's time to put the tray together. The best approach is to put it together on a smooth, level surface. The first thing I did was to glue the sides into one handle. Then, you can slide the bottom into the grooves until it bottoms out in the groove in the handle. Glue the other handle onto the tray and then apply clamps. You'll want to tighten each clamp a little bit at a time to make sure the frame stays square and doesn't twist.

And in no time, you'll be serving guests proudly with your tray. W

How-To: Creating the Handle & Shaping the Sides



First Cut. *The first cut establishes the corner underneath the handle. A solid 2x4 push block will help keep the small parts steady (and your fingers safe) as you make each cut.*



Cutting the Angle. *Move the rip fence to the other side of the blade. Flip and rotate the end piece so the groove is on top to remove the wedge. Sneak up on the height until the waste is cut away.*

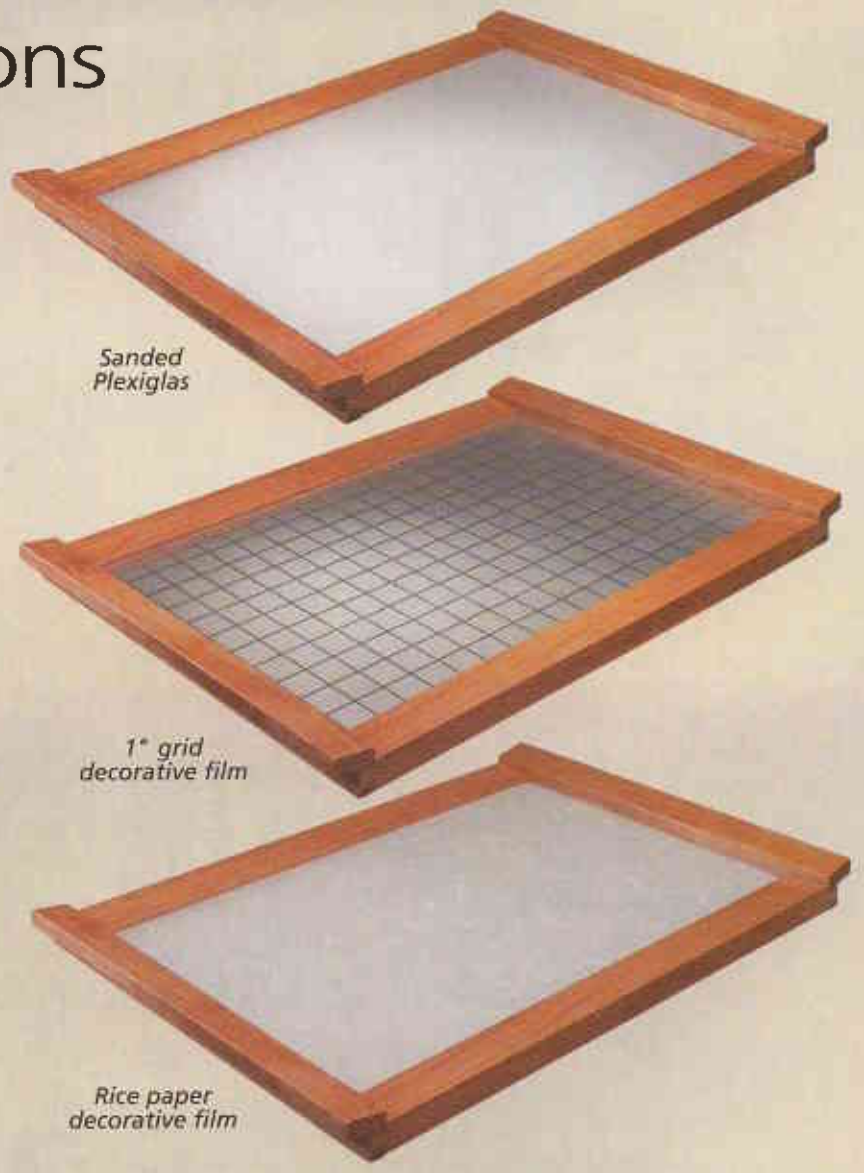
DESIGNER'S NOTEBOOK

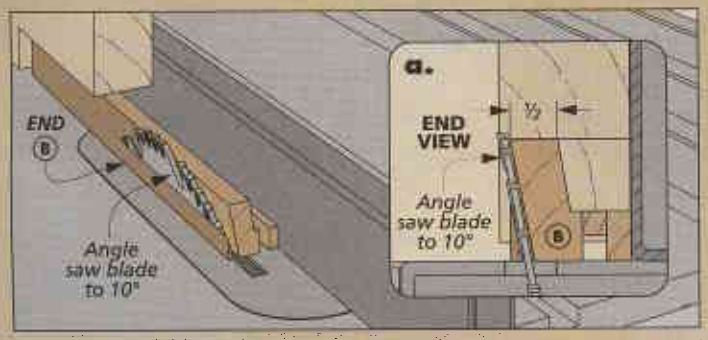
Multiple Options

One of the things I like about this project is that you can customize it simply by changing the bottom of the tray. You can make it out of ¼" hardwood plywood to match the tray frame. Or how about a figured veneer that's laminated to plywood? But for a really unique look, check out the photos on the right. They show how different materials for the tray bottom can dramatically change the look of the tray.

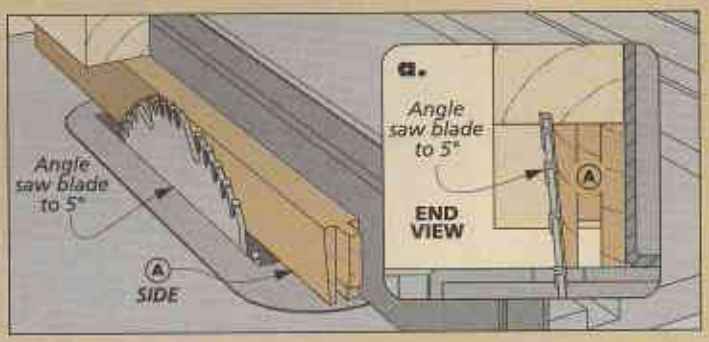
In the top photo, I sanded both sides of the *Plexiglas* with 120-grit sandpaper and a finish sander to get a "frosted-glass" look. For the middle and bottom trays, however, I applied decorative window films that I liked — a grid design in the middle and the rice paper design on the bottom.

The films are easy to apply. Just mist water on the *Plexiglas*, apply the film, and squeegee the excess water and any air bubbles from underneath. There are many other designs available too. Turn to page 49 to find a source for these films.





Final Handle Cut. *Adjust the fence, rotate the end piece again, and raise the blade to cut the final angle. The blade angle remains the same angle as it was for the previous cut.*



Side Angle. *The angle on the side pieces is not as steep as the angles for the handles. So you'll need to readjust the angle of the blade and raise its height to complete those cuts.*

tilt-out Storage Chest

This simple-to-build project features a drop-down bin that tames the clutter with easy-access storage.

The back entry at my house is like the family landing zone. It's here where all the shoes, coats, books, and more can quickly pile up. One way to tame the mess is with this simple-looking storage bench.

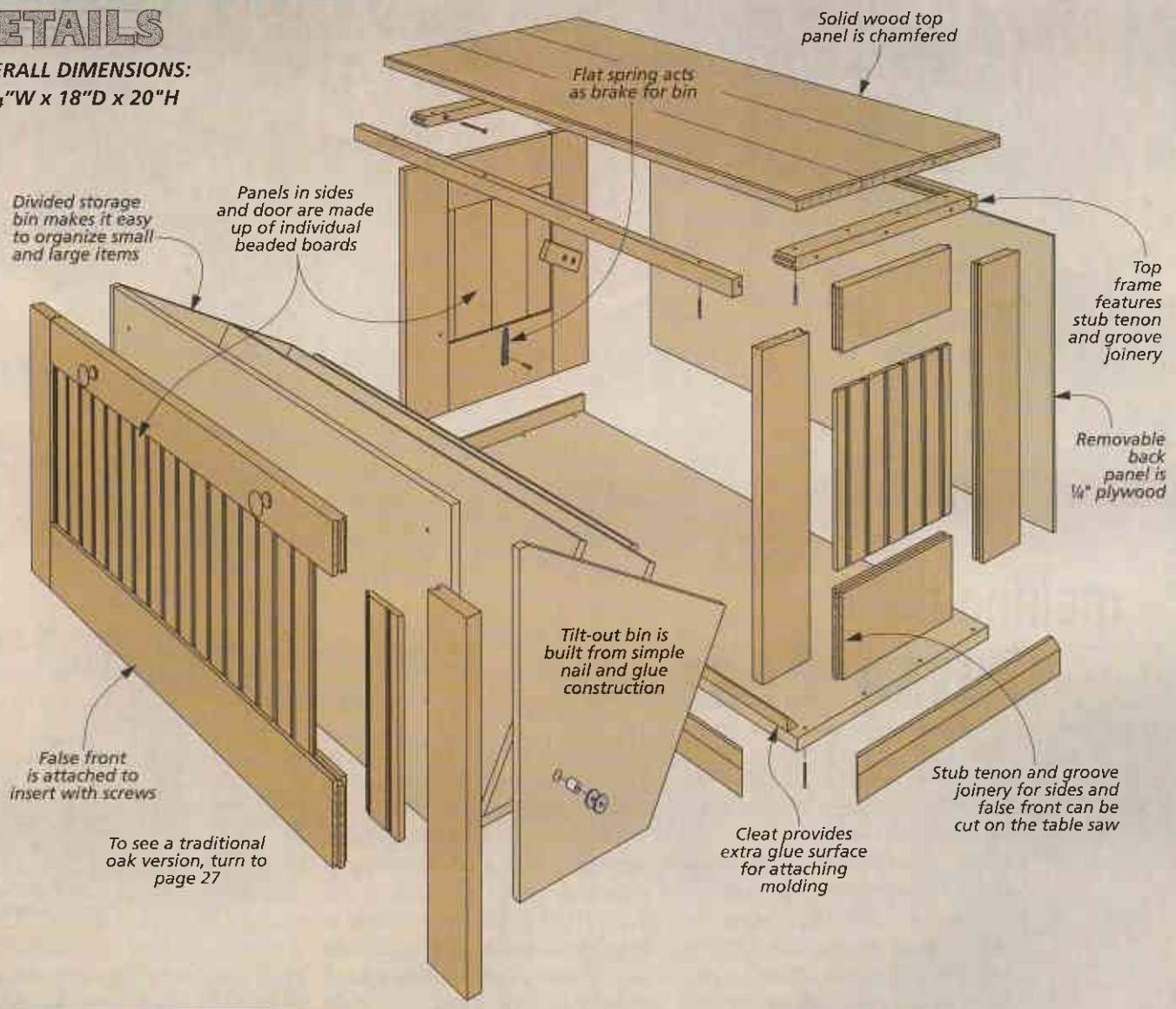
From the outside, it looks like a typical blanket chest. But with a pull of the two knobs on the front, you'll see why it's the perfect backdoor storage solution. Rather than a vast, empty case, the door reveals a drop-front, divided bin that organizes the contents of the chest and keeps it all within easy reach.

As unique as the bin is, you'll see that's it's really straightforward to build. And it has all the marks of a country classic — beaded board panels, sturdy construction, and simple, beveled molding. This painted version doesn't require expensive materials either. We used poplar and pine beaded boards that you can find at any home center. But you can easily dress it up. Take a look at the traditional-looking, oak version on page 27 to see how it's done.

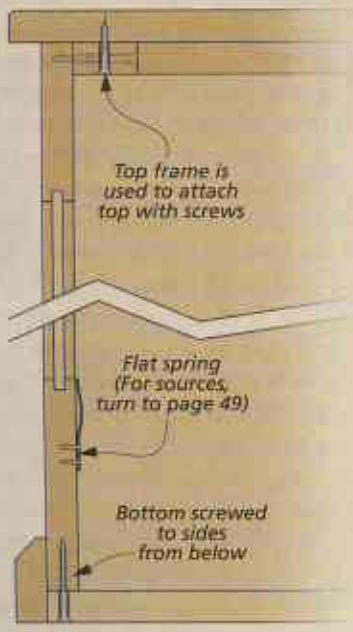
▲ The front of the chest tilts out to reveal a simple, divided plywood bin. Store larger items below and keep smaller things close at hand on the upper shelf.

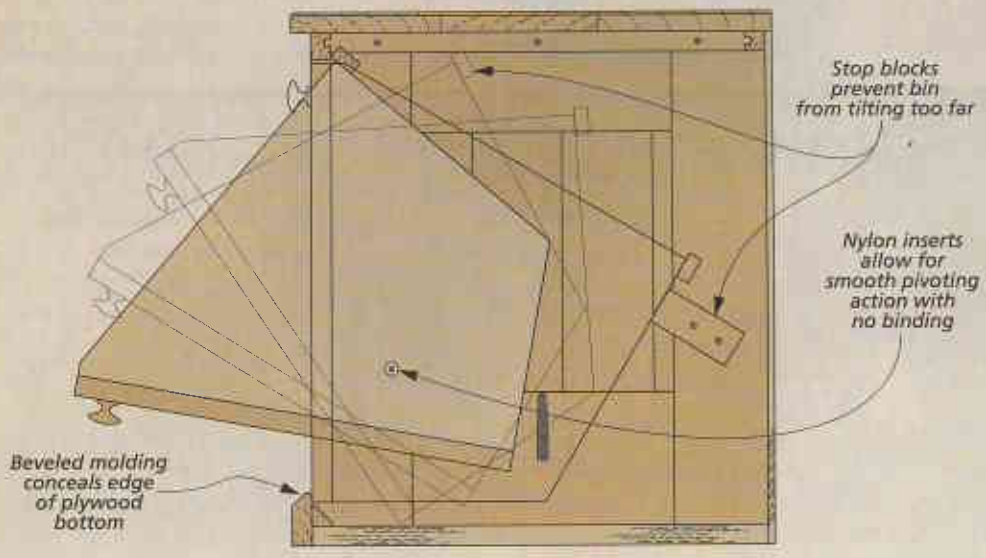
CONSTRUCTION DETAILS

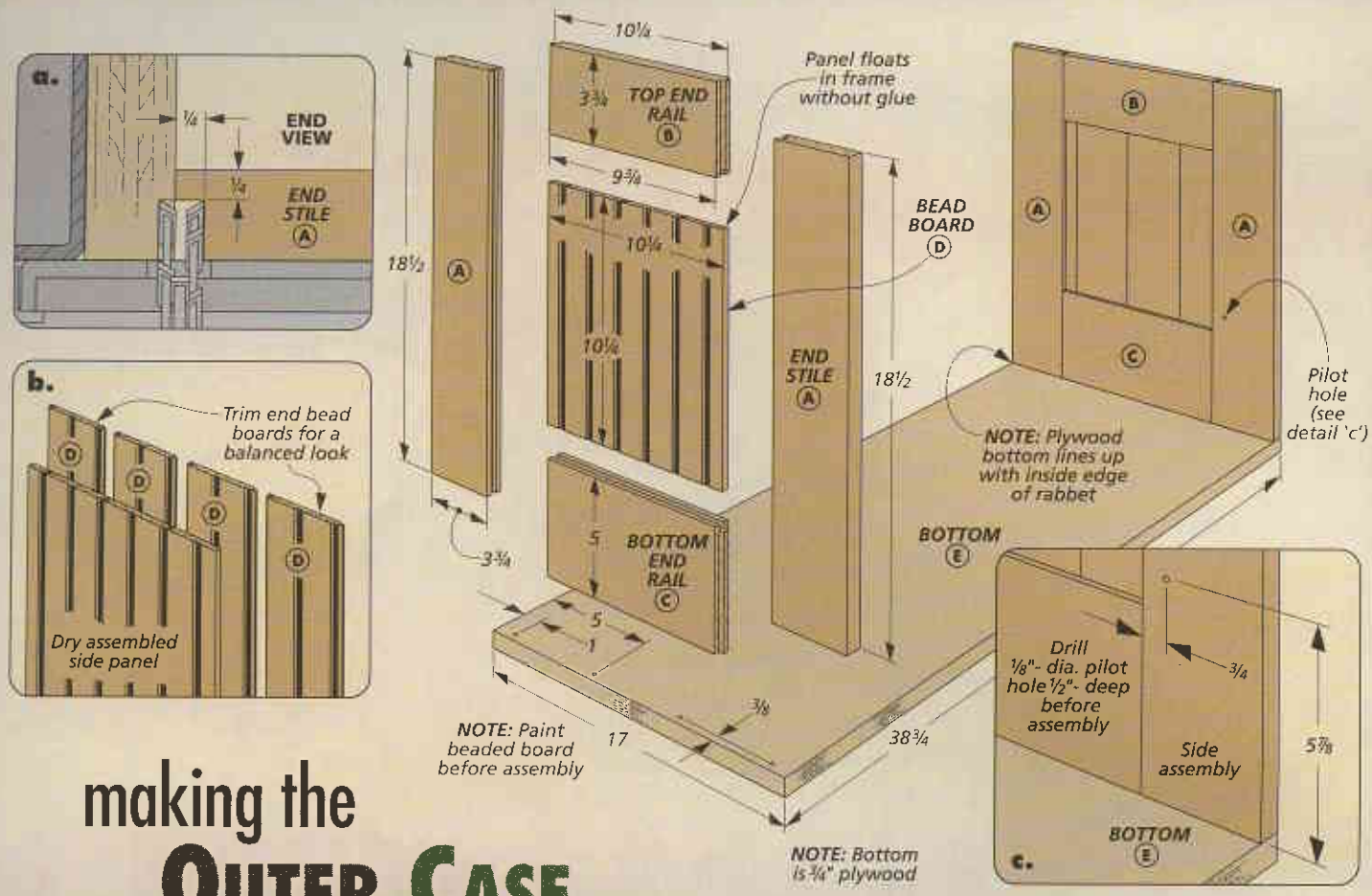
OVERALL DIMENSIONS:
40¼"W x 18"D x 20"H



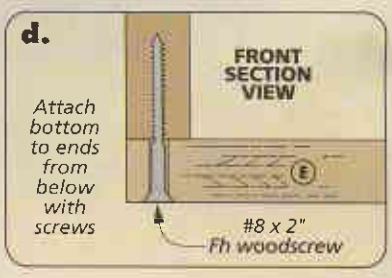
To see a traditional oak version, turn to page 27







making the OUTER CASE



I began with the outer case. The outer case is made up of two frame-and-panel end assemblies attached to a plywood base. This provides a strong foundation for the chest.

One way to streamline the process of building a project like this is to use the same joinery throughout. Here, it's all stub-tenon and groove. The box below gives you a good idea of the table saw technique used to cut the joint. So let's get started.

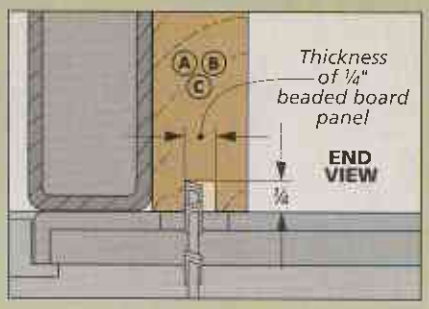
END FRAMES. The first thing to do is make the two end assemblies, as you can see in the drawing above. These are made up of a frame wrapped around a panel of solid wood beaded boards. You can find these at most home centers. The tongue and groove boards come with a bead milled into the face and a half-bead along one edge (detail 'b').

After you have the frame pieces cut down to final length and width, you can cut the grooves and stub tenons for the joinery. I sized my grooves (and stub tenons) to match the thickness of the beaded boards.

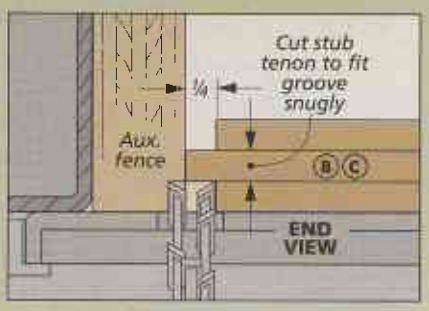
BEADED BOARD PANELS. The next step is to assemble the panels. This sounds pretty straightforward, but it will take some figuring to get a "balanced" look. What you're looking for here is to have the beads evenly spaced in the frame.

To do this, I center an oversized panel behind the frame and mark where I need to trim the end boards. To allow the panel to expand and contract, you'll want to cut the overall panel a bit narrower than the space allows. It's also a good idea to paint the beaded boards now. This way, you won't have any unpainted sections appearing as the beaded boards expand and contract.

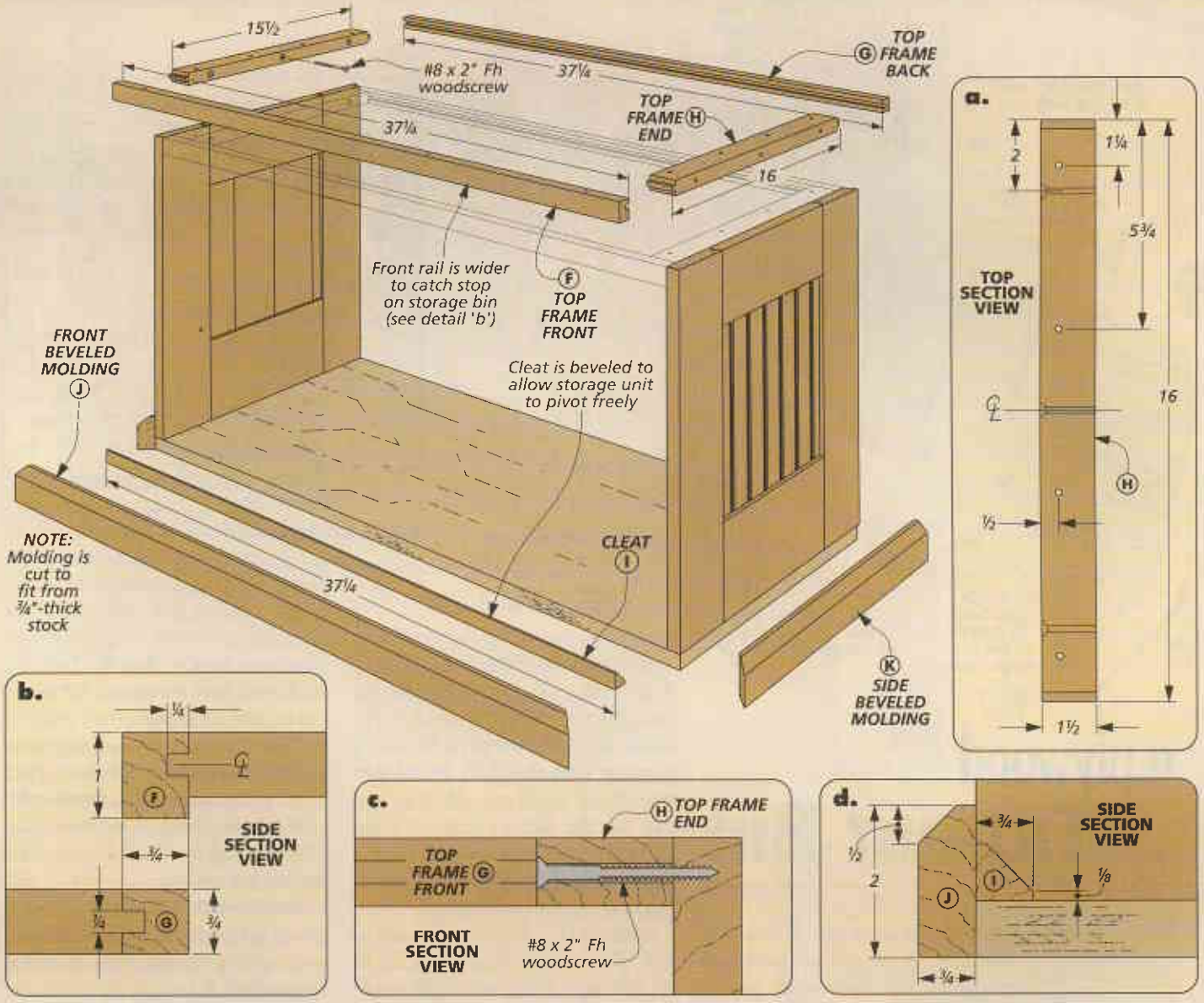
How-To: Stub Tenon & Groove Details



Grooves First. *Start by cutting a groove in all the frame parts. Flipping the piece end for end centers the groove.*



Then the Stub Tenons. *With a dado blade and auxiliary fence installed, sneak up on the fit of the stub tenon.*



COMPLETING THE ENDS. The two end assemblies can now be glued up. As I mentioned before, the beaded boards need to expand and contract, so don't glue them into the grooves. Instead, apply glue only to the stub tenons on the rails. This allows the panel to "float" in the frame.

Just two more steps are left to complete the ends. To accommodate a plywood back, I cut a rabbet along the back edge of each end (detail 'a' on the facing page).

The second step is to create a pivot point for the drop-down bin. This is simply a matter of drilling a pilot hole in the front stile of each end, as in detail 'c' on the opposite page.

PLYWOOD BOTTOM. After the frames are assembled, you can cut a plywood bottom to size. A couple of things about the bottom are worth mentioning. First, the bottom is sized to be flush with the front edge of the end assemblies and with the side of the rabbet. And, as detail 'd' on the opposite page shows, the bottom is screwed to the ends from below.

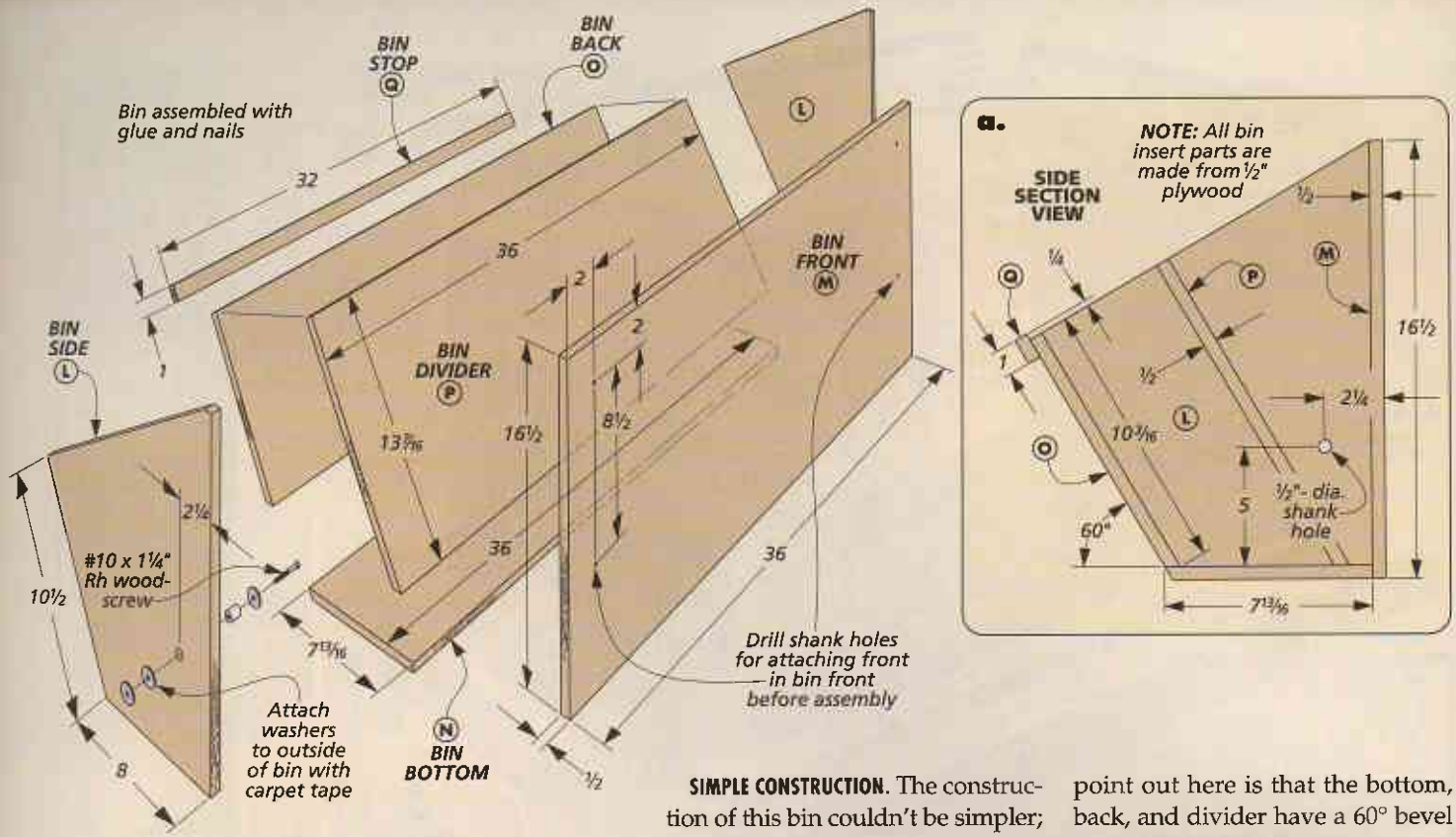
TOP FRAME. Now, you can connect the two end assemblies at the top, as illustrated in the drawing above. This open frame serves a couple of functions. First, it provides an anchor point for the top that you'll add later. Second, the front rail serves as a stop to catch the drop-down bin as it's opened. To do this, you'll notice that the front rail is wider (1") than the rest of the frame parts.

The joinery on the top frame is the same stub tenon and groove joinery that was used on the end assemblies. Before attaching the frame to the ends, I drilled a few countersunk shank holes for screwing it to the end assemblies and to add the top.

BASE MOLDING. There are just a couple of last things to do before moving on. The first is adding a cleat to the inside front edge of the case. This cleat gives a larger glue surface for the molding that runs around the bottom of the case, as you can see in detail 'd' above. I beveled the inside edge of the cleat to provide clearance for the storage bin.

The second detail to make is the beveled molding. Detail 'd' above shows all the dimensions to make it. I cut the bevel on extra-long stock and then mitered it to fit the front and two sides. (Note: There's no molding along the back edge.)

That about takes care of the case of the storage bench. The next step is to work on the bin and the inside of the case, without the back and top in place. And, for now, you can set the case aside and work on the bin.



a plywood TILT-OUT BIN

The next major section to build is the storage bin. And this is really just a plywood box with a few angles thrown in, as shown in the drawing above. A divider creates a pair of shelves that allow you to organize the contents of the bin. The entire assembly pivots on a pair of screws that anchor the bin to the case.

SIMPLE CONSTRUCTION. The construction of this bin couldn't be simpler; just glue and nails. The first thing to tackle is cutting the parts to size — starting with the ends. These two panels are small enough that you can use the miter gauge on your table saw to cut the angles. What's important here is to make sure that the two panels are identical.

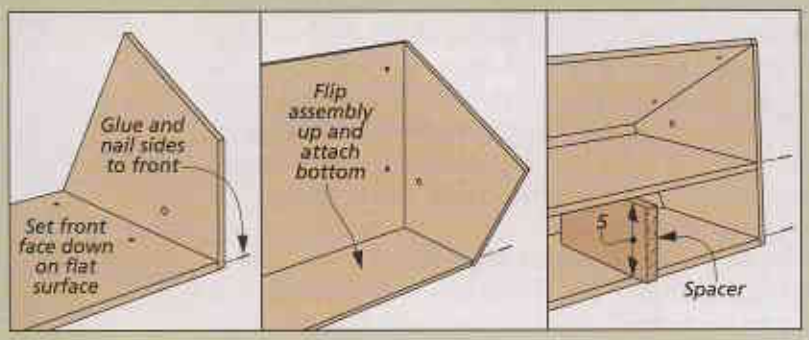
PIVOT HOLES. With the sides cut to size, there's one other thing left to do before moving on to the other bin parts. And that's to drill a shank hole to hold the pivoting screw and a nylon bushing (detail 'a').

The next step is cutting the rest of the pieces to size. These are straightforward panels. The only thing to point out here is that the bottom, back, and divider have a 60° bevel cut on one edge (detail 'a').

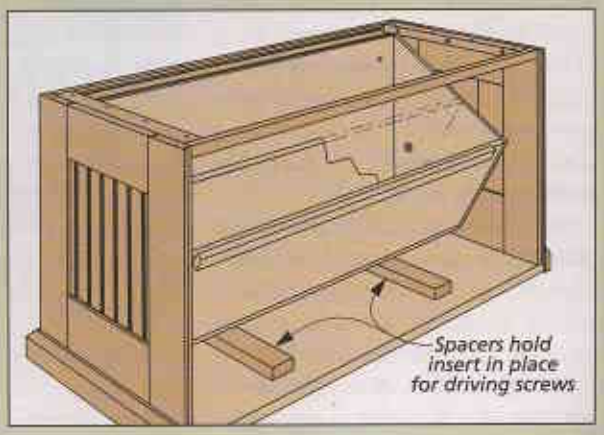
There's just one more thing to do before assembling the box. And that's to drill some some shank holes in the front panel of the bin. They will be used to attach a door once the bin is installed.

ASSEMBLING THE BOX. At first glance, putting the tilt-out bin together seems pretty challenging with all the angles. But if you do things in the correct order, the results are guaranteed. The box on the bottom of the page shows the process. A brad nailer and some glue can make quick work of this job. But using a handful of screws would work just as well.

How-To: Assembly Details



Assemble the Bin. *Start with the front face down and attach the angled sides (left drawing). Then set the bin upright to attach the bottom panel (middle). Turn the bin on its back to attach the back and the divider (right).*



Install the Bin. *Cut spacers to support the bin so the pivot holes line up with the holes in the case. Use a third spacer at the front to set the front-to-back position.*

In order to keep the bin from tipping completely out of the chest, I made a plywood stop. For added strength, it's glued and nailed to the top edge of the back, as shown in detail 'b' at right.

INSTALLING THE BIN

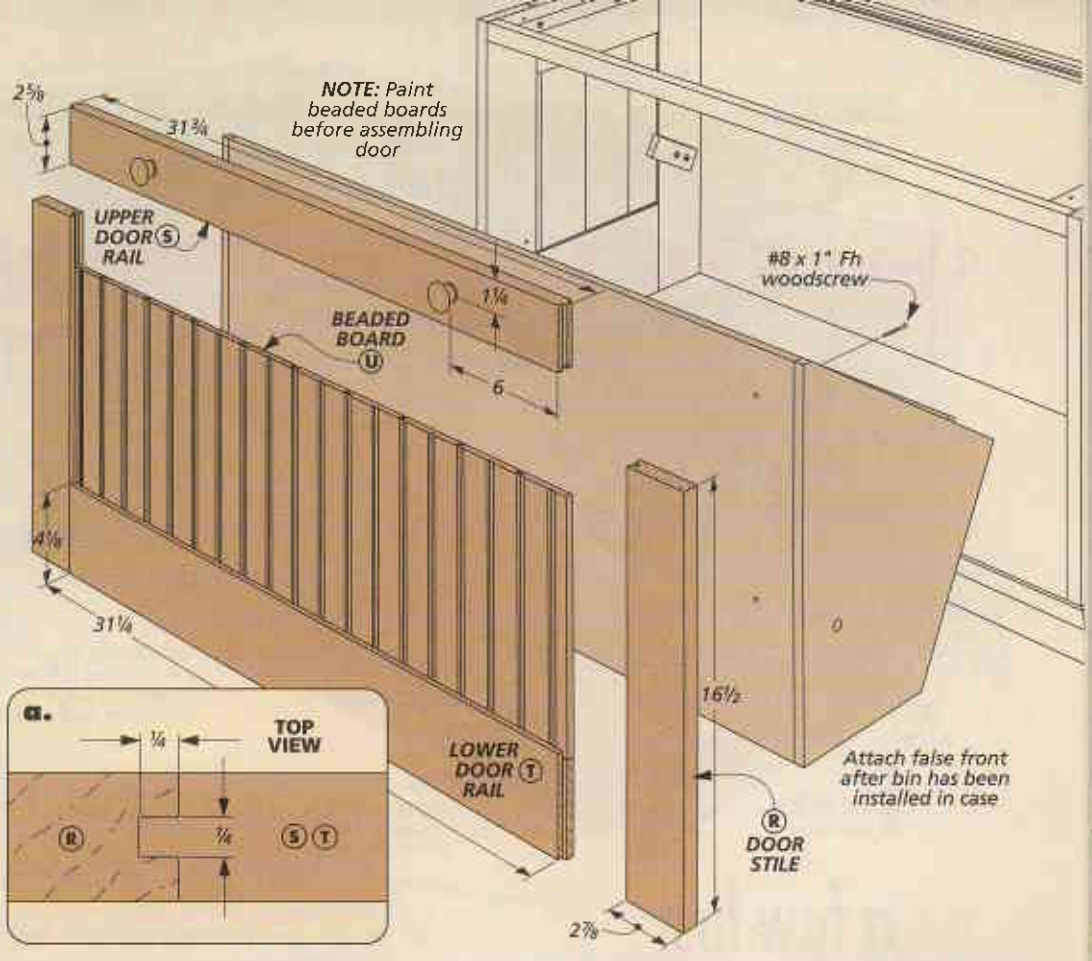
At this point, you can now install the bin in the case. After this step is complete, the false front door will be built and attached.

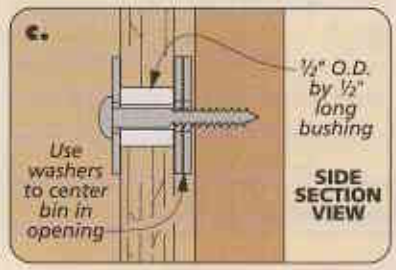
SPACERS FOR SUPPORT. Since you've pre-drilled the holes in the case sides and bin sides, everything should go smoothly. The real challenge is supporting the bin in the right position while driving the screws in place. To make this task easier, I used a few spacers. I cut a pair to support the bin so the holes in the bin line up with the pilot holes in the case.

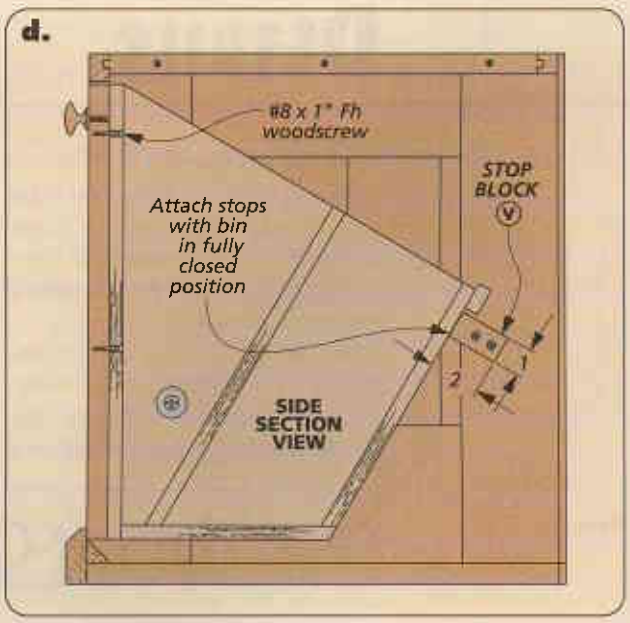
SIMPLE PIVOT HARDWARE. Before setting the bin in place and attaching it to the case, there are a couple of prep steps to take. The first is to slip a pair of nylon bushings in the pivot holes in the bin. The bushings will make the pivoting action smoother and cause less wear and tear on the sides.

Then, to center the bin in the opening, I carpet-taped a few washers to the outside. I also used the washers to prevent the bin from binding on the case. Just how many washers you'll need depends on the gap between the bin and case. In my case, I used two washers on each side. The carpet tape holds them in place while driving the screws.

BIN STOP. There's one last thing to do inside the case. And that's to provide a way to support the bin when it's closed. To do this, I screwed stop blocks to the case, as you can see in detail 'd.'



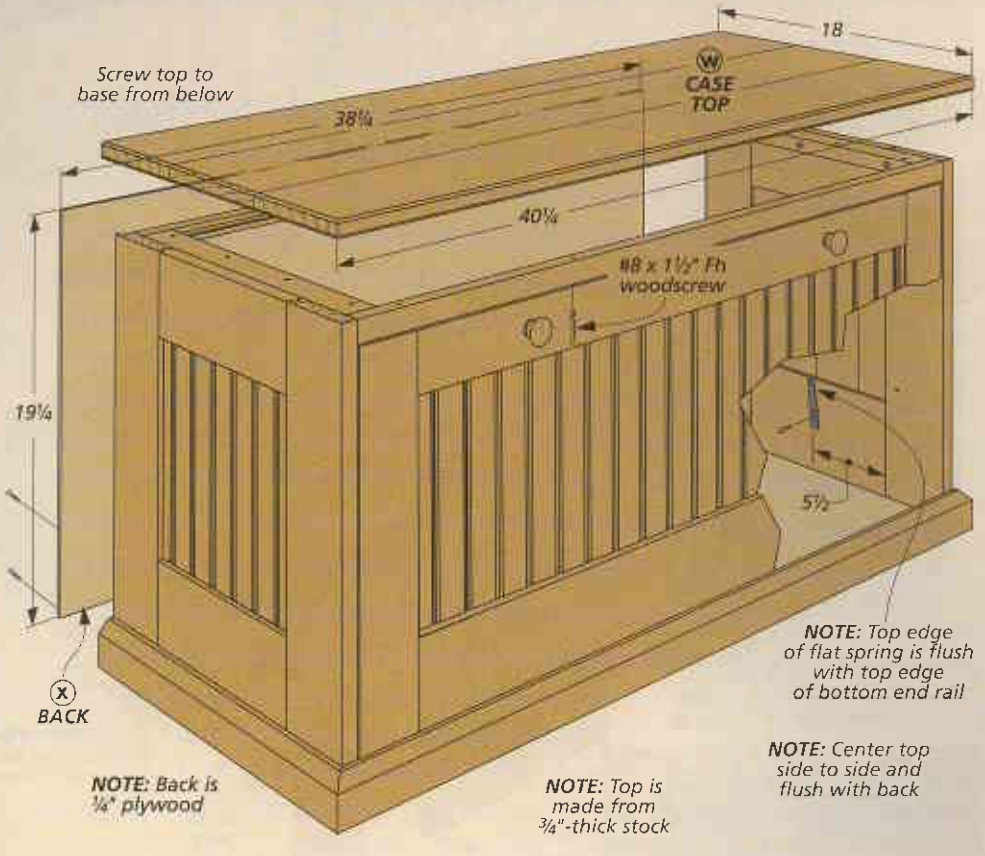


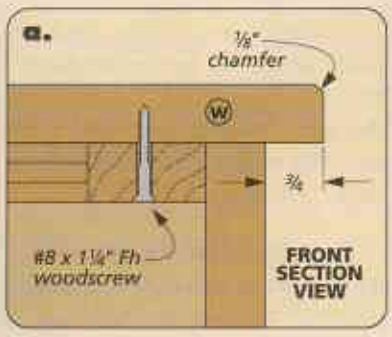


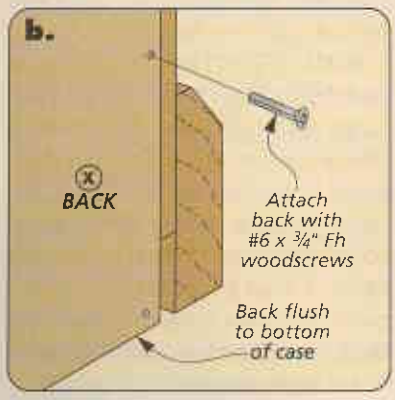
MAKE THE DOOR. With the bin taken care of, you're down to building one last frame-and-panel assembly. This time, it's for the door on the tilt-out bin. And like the case ends, the frame wraps around a beaded board panel. Even the joinery is the same — stub tenon and groove. You can find all the details for the joinery in the drawing above and detail 'a.' The beaded boards are centered in the frame the same way as those in the ends of the case.

CONSISTENT GAPS. Once the door is complete, it's just a matter of screwing it in place on the bin. The only thing to note here is that you want to make sure the gaps on either side and top of the door are consistent. (The bottom of the frame drops behind the base molding on the case, so that gap isn't visible.)

ATTACH THE DOOR. It can be a challenge to get a screwdriver down in the bottom of the bin to attach the door. To make things easier, I clamped the door in place and then marked the location of pilot holes from the bin front. Size the pilot holes so they are large enough to make driving the screws by hand easier but still have plenty of "bite" for the screw threads.







a few last DETAILS

Once the tilt-out bin is built and installed, there are just a few other things to take care of before it's complete. After attaching a final bit of hardware, you'll add the solid-wood top and plywood back.

FLAT SPRINGS. First comes the hardware. I wanted to add a little more control and a "soft-close" feature to the bin. And in the drawing above, you can see how I did this. A pair of flat springs are screwed to the inside of the case. These springs act like brakes to prevent the bin from slamming closed when it's packed full. You can read more about them in the box below.

GLUED-UP TOP. At this point, all the work inside the chest is complete. So you can now close it in.

The first step here is to make is the solid-wood top panel. This is nothing more than a wide, ¾"-thick glued-up panel. Once it's smoothed and cut to final size, I routed a slight chamfer on all the edges. Before attaching the top to the case, it can be primed and painted.

The top is screwed to the case from below. Here, you use the shank holes you drilled earlier when building the upper frame (detail 'a'). I centered the top on the case to mark the screw locations and drill pilot holes. Now, it's just a matter of driving a few screws in place. I only lightly snugged up the screws. This allows the top panel to expand and contract without placing too much stress on the case.

BACK PANEL. The final panel to make is the back. And this couldn't be simpler. It's cut from ¼" plywood to fit inside the rabbets in the case sides. You have a few choices for fastening the back in place: glue, nails, or screws. And all would work out just fine, but I chose to use screws. Using screws makes it easier to remove the back in case you need to get inside later, as shown in detail 'b.'

Even though the back of the case will be placed against the wall, I still painted both sides of the back panel to match the rest of the bench for a consistent, finished look.

With the chest complete, you can set it in place by the back door and take control of the clutter. W

Shop Tip: Soft-Close Springs

The tilt-out bin can get pretty heavy when it's fully loaded. To slow things down a bit, I added a pair of flat springs. They're screwed to the inside of the case and act like brakes to slow the movement of the bin. As the bin closes, it rubs against the springs and compresses them, which slows the closing of the bin.

You can control just how much of a braking effect the springs offer. I used a pliers to increase the bend in the springs for an added measure of safety. You probably won't find these springs in a hardware store, so turn to page 49 for sources.

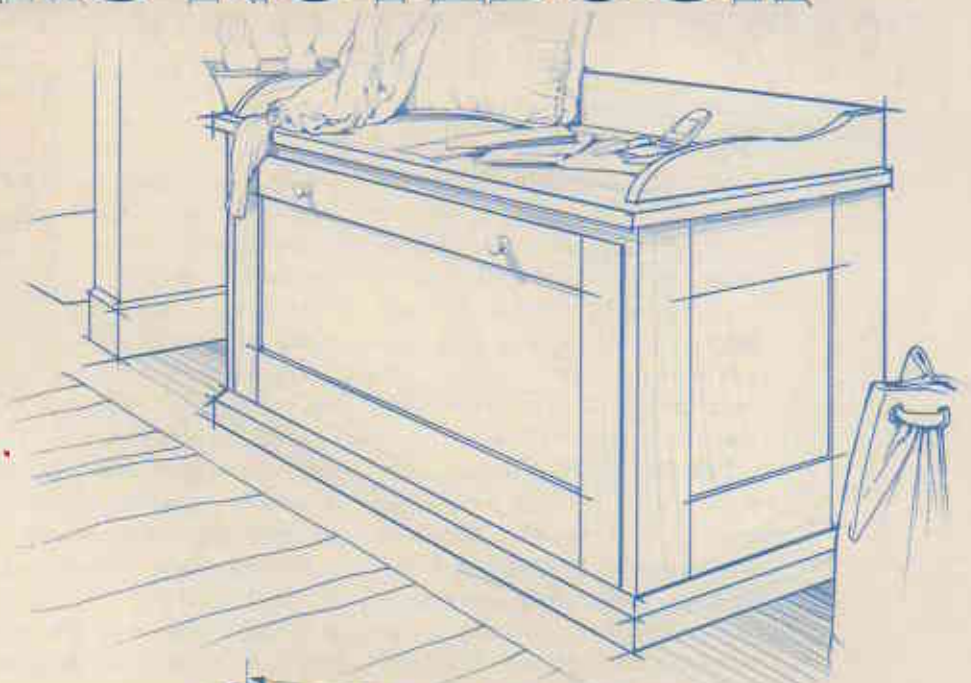
DESIGNER'S NOTEBOOK

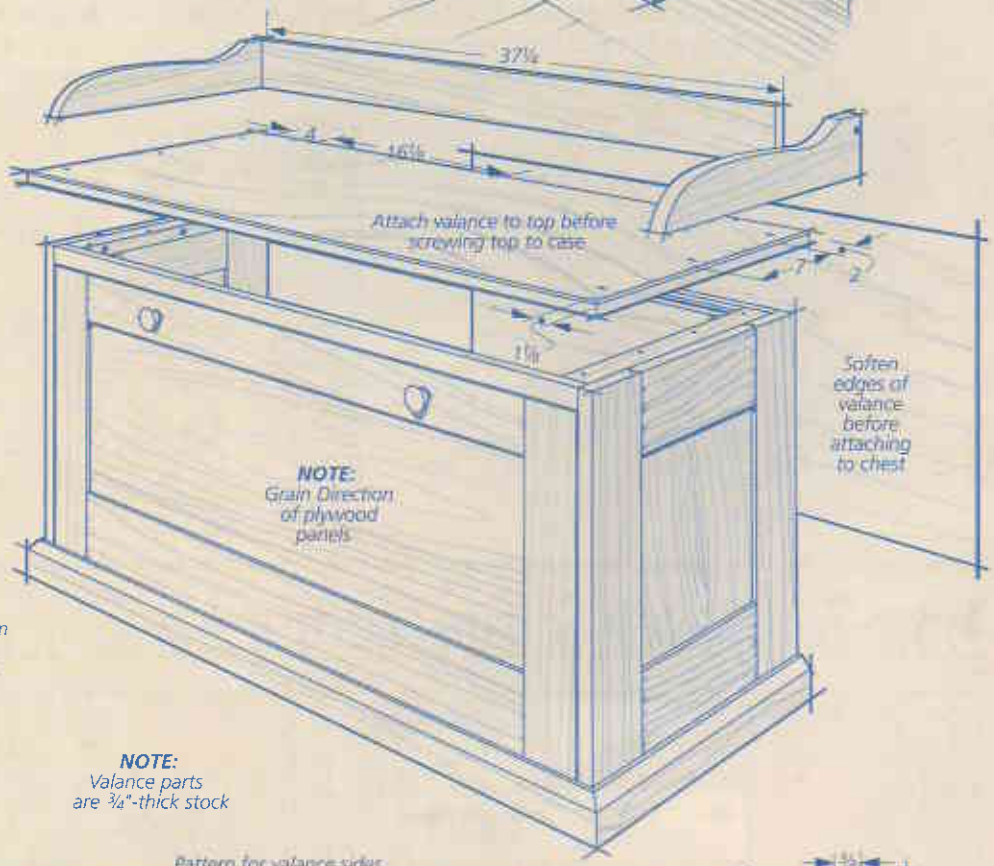
Traditional Oak Chest

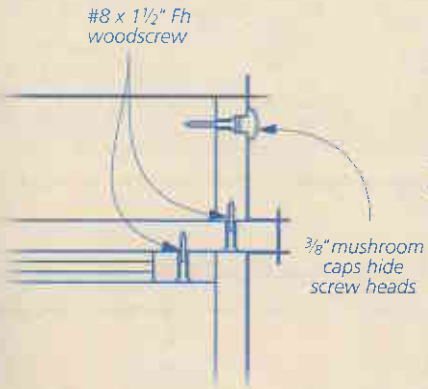
You can alter the look of the tilt-out storage chest with a few simple changes. First off, instead of using poplar and paint, this version is made from red oak and is finished with polyurethane.

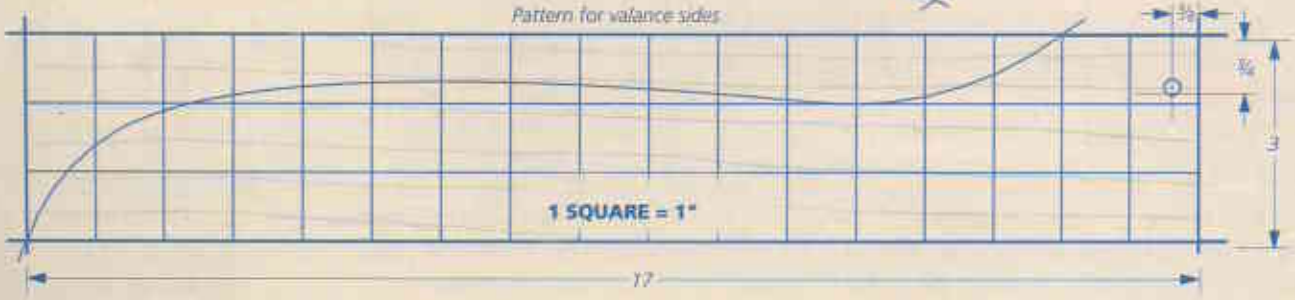
I also replaced the beaded board panels with ¼" oak plywood. These panels can be glued in place to stiffen the door and ends.

The final change I made to the chest is to add a three-sided valance to the top. The pattern for the curved sides is shown below. The valance is assembled and screwed to the top panel from below before attaching the top to the case.

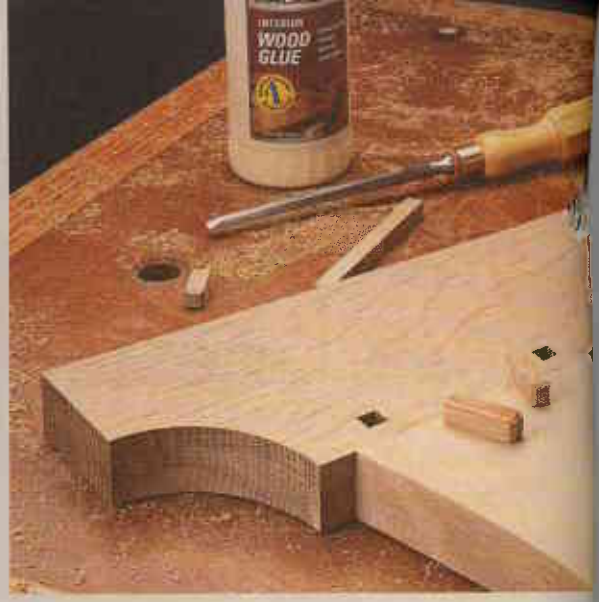








SHOP NOTEBOOK



Square Pegs

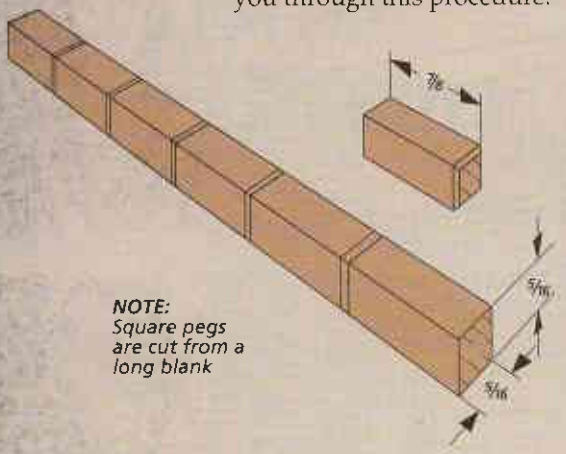
One of the details that gives the grandfather clock on page 30 the look of an authentic Craftsman-style project is the square pegs used at each joint on the case front. But these pegs aren't just for looks. They actually pass through the tenons, pinning them in place and preventing them from working loose.

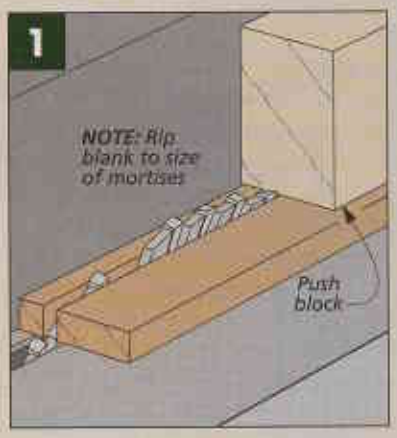
TWO-STEP PROCESS. Installing the square pegs is really a two-step process. First, you have to create a square mortise for each peg. This is simply a matter of drilling out the waste and then squaring up the sides of each mortise with a chisel. The How-To box below will walk you through this procedure.

FIT THE PEGS. The second step is to make the square pegs to fit the mortises. To do this, I started by planing a blank to match the width of the mortises ($5/16$", in my case). Next, I ripped the blank into strips that were also $5/16$" wide (Figure 1). A push block will help you to safely rip these strips.

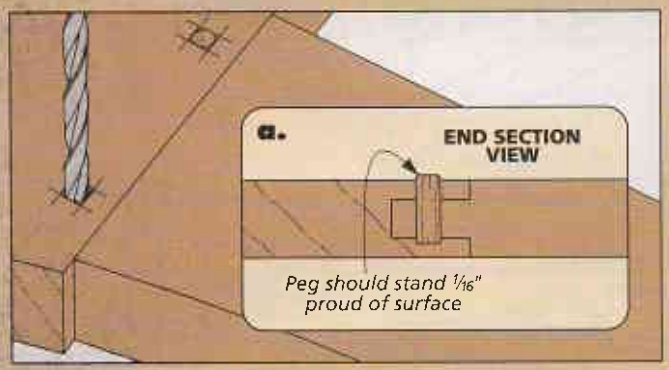
The next step is to cut the strips into individual pegs. The trick here is to cut the pegs to the correct length. The goal is for the pegs to end up standing about $1/16$" proud of the surface. But it's better to make the pegs a hair short and just not tap them into too far than to make them too long.

Before gluing the pegs in place, I sanded a small ($1/32$") chamfer on the end of each one, as you see in Figure 2. Once this is done, you can apply a little glue and drive the pegs in place with a mallet.

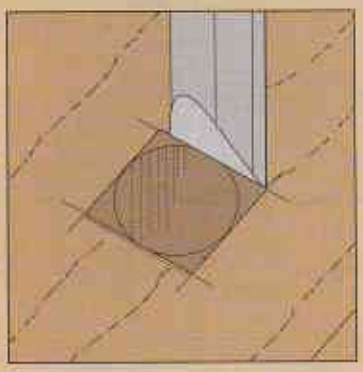




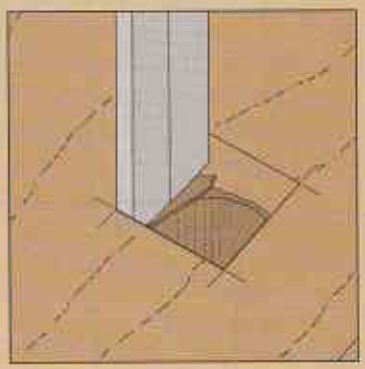
How-To: Make a Square Mortise



Drill Out Waste. *Using a $5/16$"-dia. drill bit, drill a hole for each peg. Drill the holes deep enough to pass through the tenon, but stop before the bit exits the underside of the workpiece.*



Score Sides of Mortise. *Carefully mark out the edges of the mortise with a sharp chisel.*



Square Up Sides. *Remove the remaining waste and square up the sides of the mortise.*

Making Curved Glass Stop

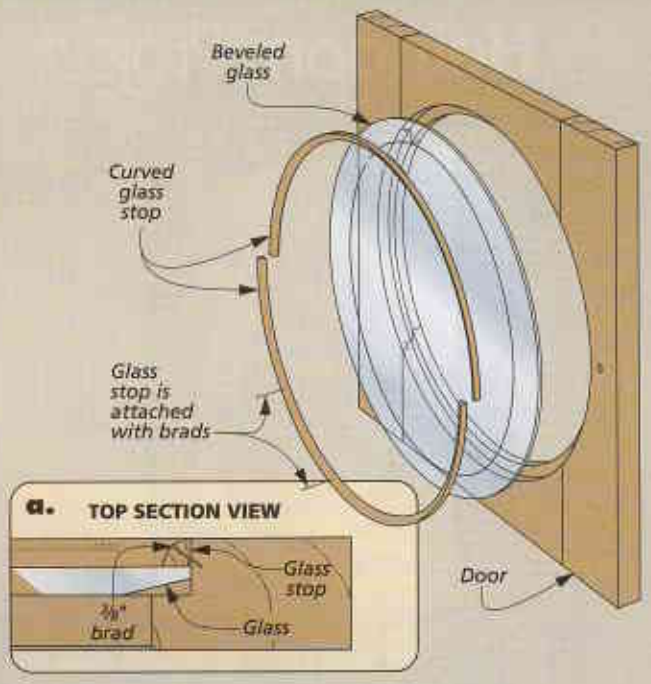
The upper door of the grandfather clock uses a piece of round glass. And in order to hold this glass in place, I made some curved glass stop.

The glass stop is made using a bent lamination technique. If you've never tried this before, it's actually pretty simple. All you do is glue and clamp up several thin strips in a contoured form. Once the glue dries, the laminated strips retain the shape of the form.

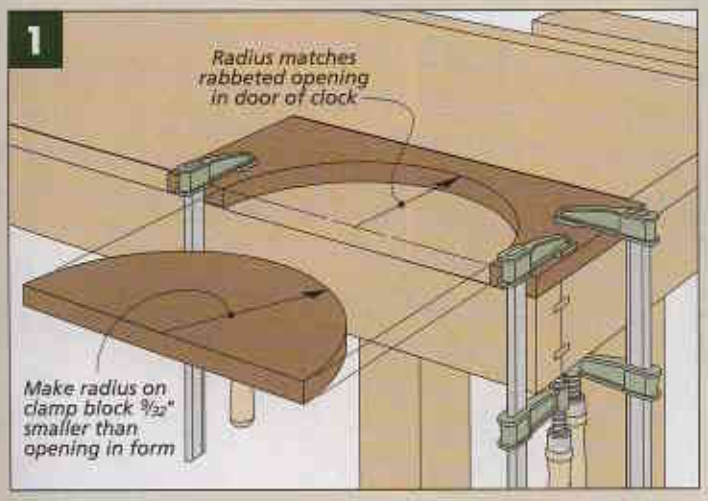
FORM. To make the curved glass stop, I started by making the form. This is nothing but a piece of 3/4" MDF with a half circle cut out of one edge, as you see in Figure 1 below. I cut out the half circle on the band saw and then sanded the edges of both pieces smooth. Then I rubbed some paraffin wax on the edges of the form to prevent any glue squeezeout from sticking to it.

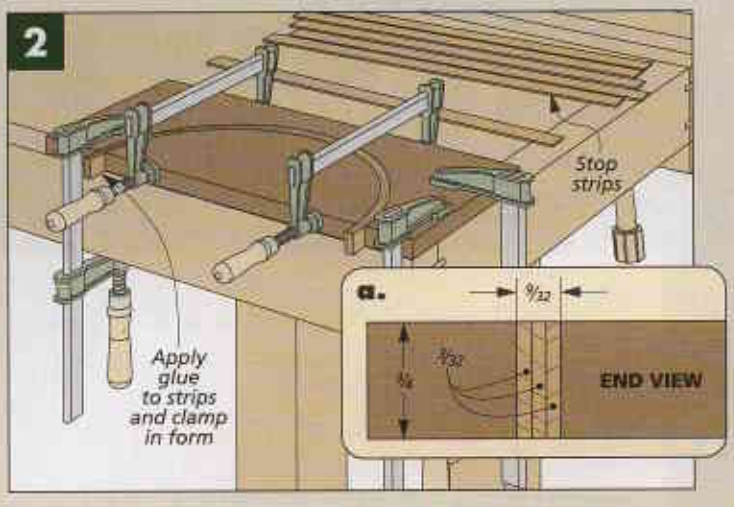
LAMINATIONS. The next step is to rip some 3/32"-thick strips from the edge of a piece of 3/4"-thick stock. These will be the laminations for the glass stop. You'll need three strips for each piece of glass stop (six strips total). Make sure to cut these a little longer than necessary so that you can trim them to exact size after they're glued up.

GLUE UP THE STRIPS. Once you've finished ripping the strips, you can glue them up in the form. Glue up three strips at a time, and let the glue dry overnight before removing the blank from the form. Then glue up the other three strips for the second blank.



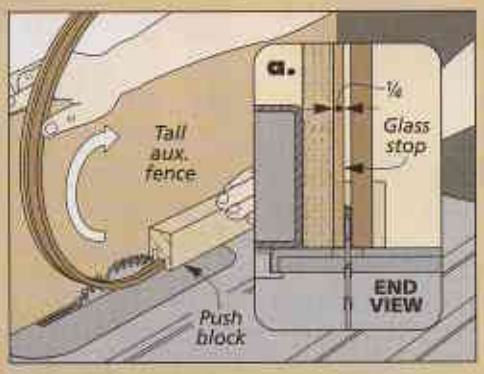
Finally, the last step is to shape and cut the glass stop to final size. To see how this is done, take a look at the box below. W





Complete the Curved Glass Stop

Rout a Roundover. *After scraping off any excess glue, rout a 1/4" roundover on one edge of each laminated blank.*



Rip Glass Stop to Width. *With a tall auxiliary fence attached to your table saw rip fence, carefully rip the glass stop from the blank.*

Trim to Length. *Using a hand saw, trim the ends of the two pieces of glass stop to fit the opening in the door of the clock.*

craftsman-style Grandfather Clock

Perfect Craftsman details and traditional joinery all come together in this classic project.

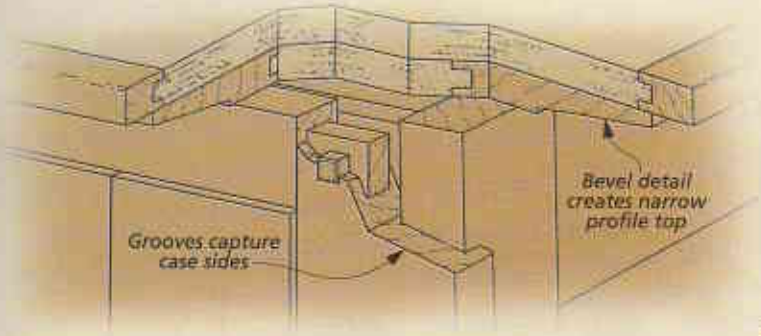
It's hard to look past the impressive stature and unique Craftsman-style details of this grandfather clock and take note of all the interesting woodworking that goes into building it. But I guarantee this project will be a great way to spend some quality shop time.

The rock-solid frame and panel case at the heart of the project and the traditional mortise and tenon joinery make it happen. The slight top to bottom taper of the case adds a classic, Craftsman touch. And when you put a pendulum movement with a Craftsman-style clock face behind the two beveled-glass doors, it all comes together. To be honest, the photo at right really says it a lot better than I can.

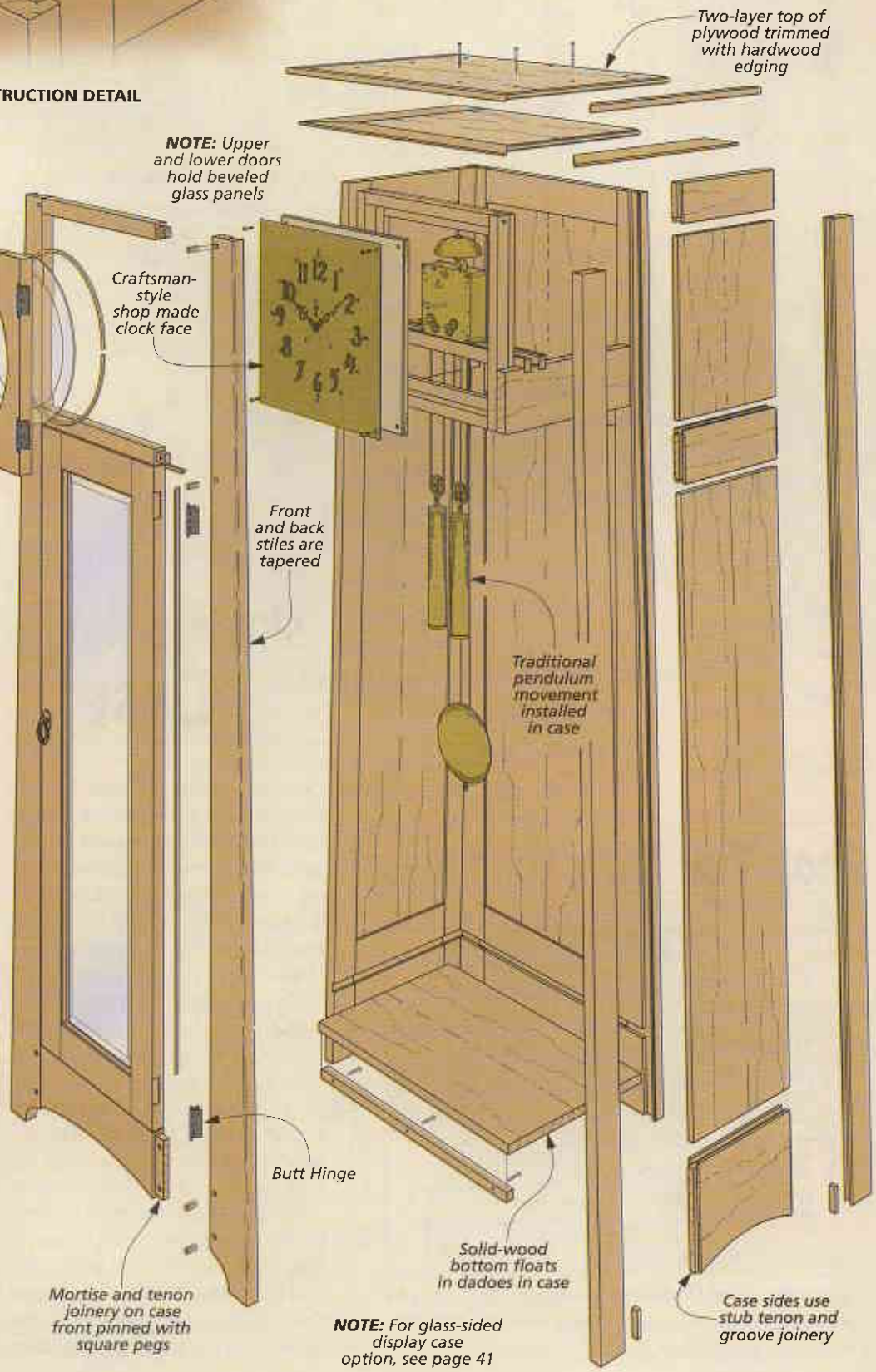
But it's possible that a grandfather clock with a traditional movement doesn't fit your needs. Well, with a few easy modifications, the clock case can be transformed into the glass-sided display case you see in the photo on the opposite page. It might be a hard choice which clock to build. Either way, you can't go wrong.

CONSTRUCTION DETAILS

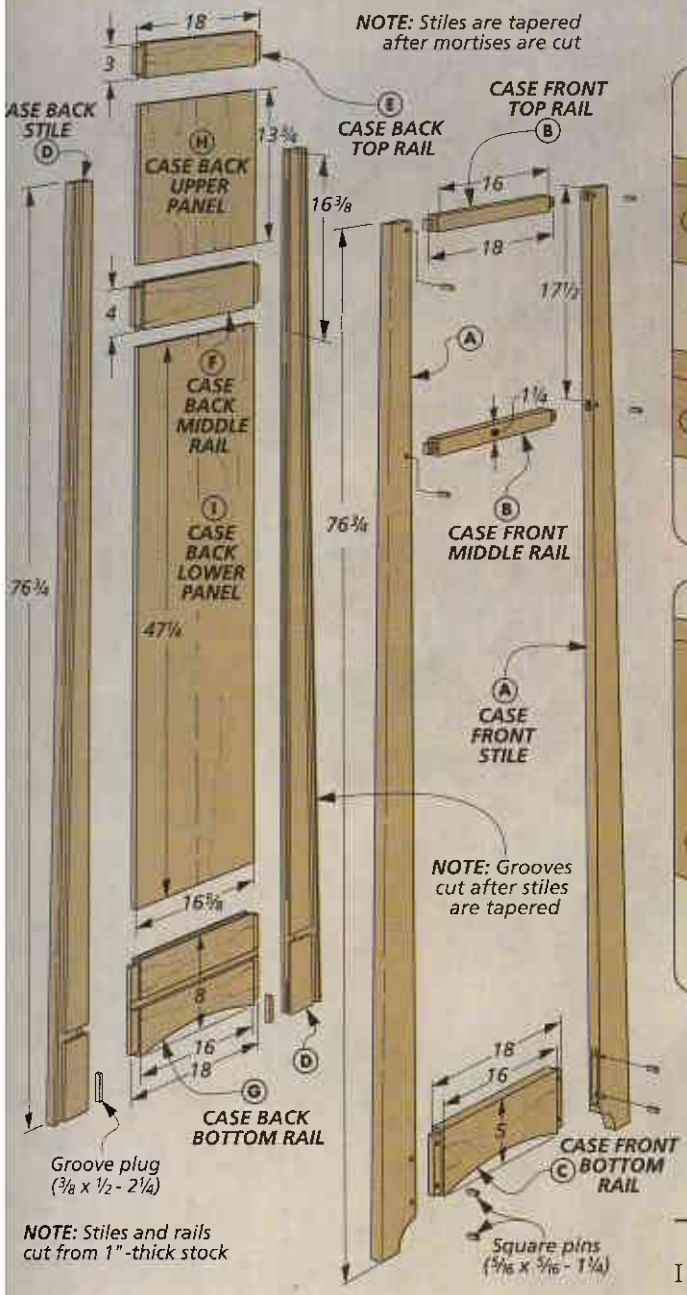
OVERALL DIMENSIONS: 27"W x 19½"D x 77¾"H

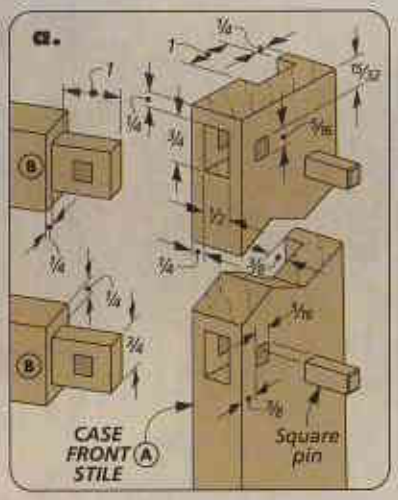


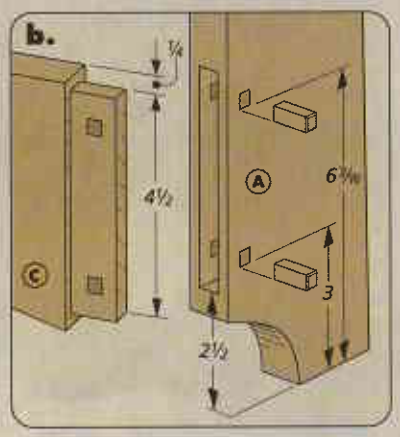
TOP CORNER CONSTRUCTION DETAIL

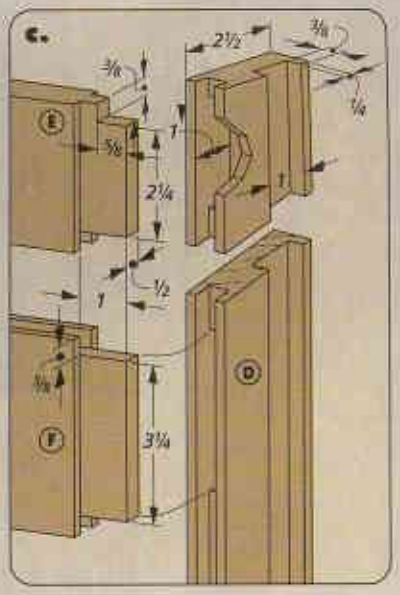


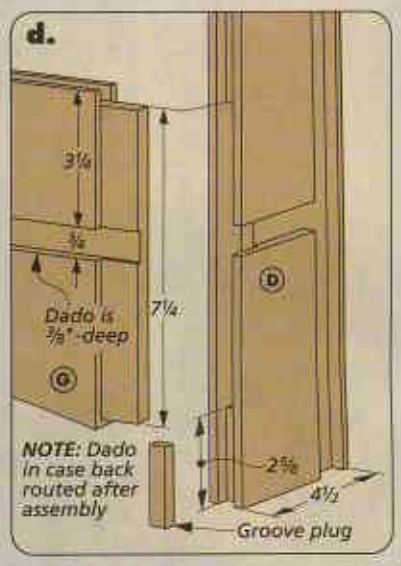
With a switch to a quartz clock movement and glass panels in the sides, the clock becomes a handsome display case.











starting the CASE

I started work on the clock by putting together the two frames that form the front and back of the tall case. The distinctive feature here is the gentle, top-to-bottom taper of the frames. This look is created by simply trimming the outside edges of the stiles, so you'll find it doesn't really complicate the construction.

The overall dimensions of the front and back frames are identical, but as you can see in the drawing above, the details are a little different. So, I started by assembling the front frame and then building the frame and panel case back.

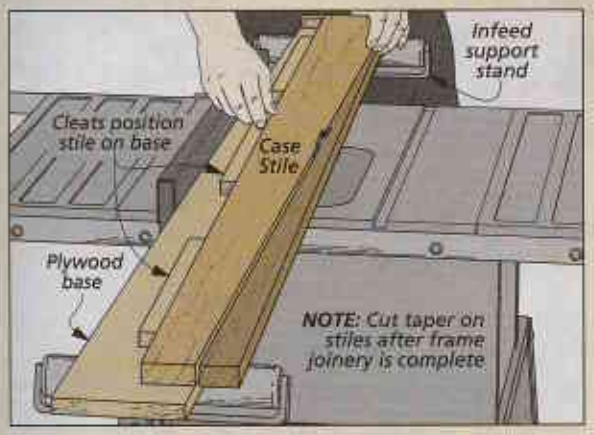
THE FRONT FRAME. The front frame is simple mortise and tenon construction. First, you'll want to cut the two front stiles to rough width and final length from 1"-thick stock. But don't worry about tapering them at this point. Cutting the mortises is easier with the stiles "square."

MORTISES FIRST. Next, I laid out the three mortises on each stile (details 'a' and 'b') and took them to the drill press to remove the waste (How-To on facing page). A stop at the bench to clean up the mortises with a chisel completes the work.

Once the mortises are done, you can taper the outside edges of the stiles at the table saw using the sled shown in the lower left box.

GROOVES. Now, it's time to plan ahead for a solid connection between the front and back and the two sides. To accomplish this, the inside faces of the stiles have a 1"-wide groove that will hold the side assemblies (detail 'a'). The grooves simply follow the outside taper of the stiles. This makes the assembly

Shop Tip: Taper the Stiles



A Long Tapering Sled. *Once the mortises on the stiles have been completed, a simple table saw sled will allow you to quickly and accurately cut the long tapers.*

a lot easier and the case sturdier. I used a dado blade on the table saw to get the job done.

The final detail on the stiles is a rounded cutout at the bottom that complements a shallow curve on the bottom rail. The shop tip at the far right provides the layout.

THREE RAILS. Next up are the three rails. This work is simply a matter of cutting them to size and then adding tenons to the ends (details 'a' and 'b'). And you can finish up by laying out a shallow curve on the bottom rail and cutting it at the band saw (near right drawing).

PUT IT TOGETHER. At this point, the front frame is ready to assemble. There are a couple things to to keep in mind here. When you clamp up the frame, be careful not to crack the lip separating the outside edge of the stiles from the groove. And even though the outside of the frame tapers, you want to be sure the door openings are square.

SQUARE PINS. After the clamps are put away, one final "Craftsman" touch completes the front frame. The tenons are pinned with square pegs that stand proud. You'll find more about this on page 28.

THE BACK FRAME. With the front frame complete, I turned my attention to the frame and panel back. Here, the tapered stiles are identical in size — the difference is the rails and the addition of the panels.

I started by cutting the two stiles and the three rails to length and rough width. Then you can cut the ½"-wide centered grooves that will hold the stub tenons and the panels (How-To box below).

Now, the joinery follows the same routine as the front frame — three mortises in each stile and snug-fitting tenons on the ends of each rail (details 'c' and 'd'). And here again, the bottom rail is treated to a shallow curve.

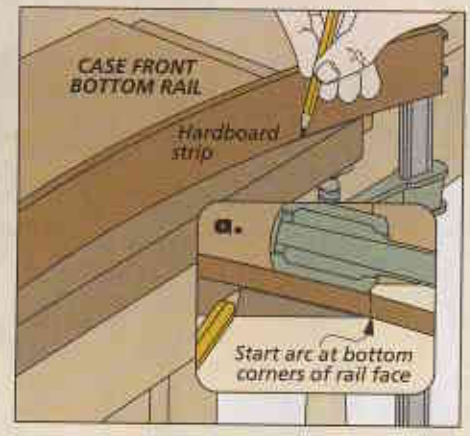
With the joinery out of the way, you can taper the stiles. And the stiles are completed by cutting the grooves to hold the case sides.

ADD PANELS. Before assembling the back frame, you need to make a couple of ½"-thick solid-wood panels. Since the inside of the lower panel is visible through the door, you want to be sure it looks good from this side as well.

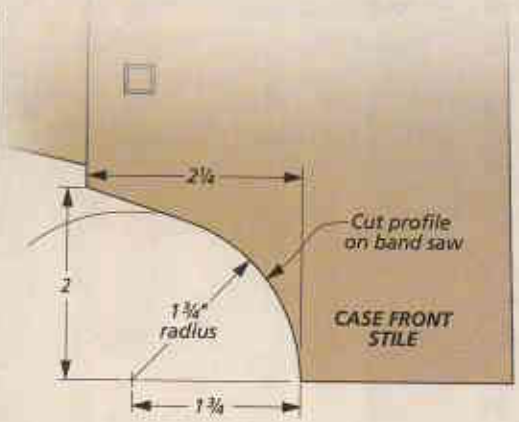
When you cut the panels to size, just remember to leave a little side-to-side play. And when you assemble the back frame, don't be tempted to glue the panels in place.

A DADO. Once the back is assembled and the clamps come off, there's one more thing to take care of before moving on to the two sides. The solid-wood case bottom, added later, fits into dadoes routed into the back and two sides (it's simply glued to the front frame). So you'll need to rout a stopped dado across the bottom rail between the two grooves in the stiles. The right drawing in the box below gives the details.

Shop Tip: Stile and Rail Profile



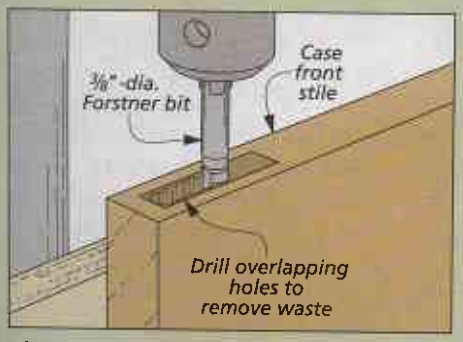
A Smooth Curve. *A pair of clamps and a thin strip of hardboard "bowed" between them are all it takes to draw a smooth curve.*



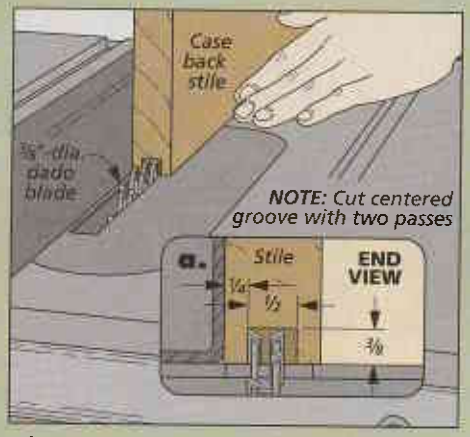
Not a Simple Radius. *The rounded cutout on the bottoms of the front stiles is elongated to tie into the curve of the bottom rail.*

▲ Chamfered, square pegs set off the front frame. You'll find more details on page 28.

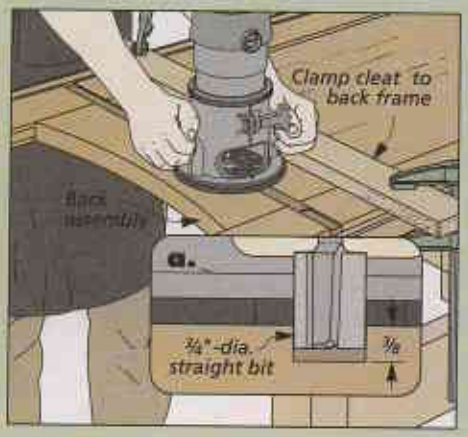
How-To: Joinery



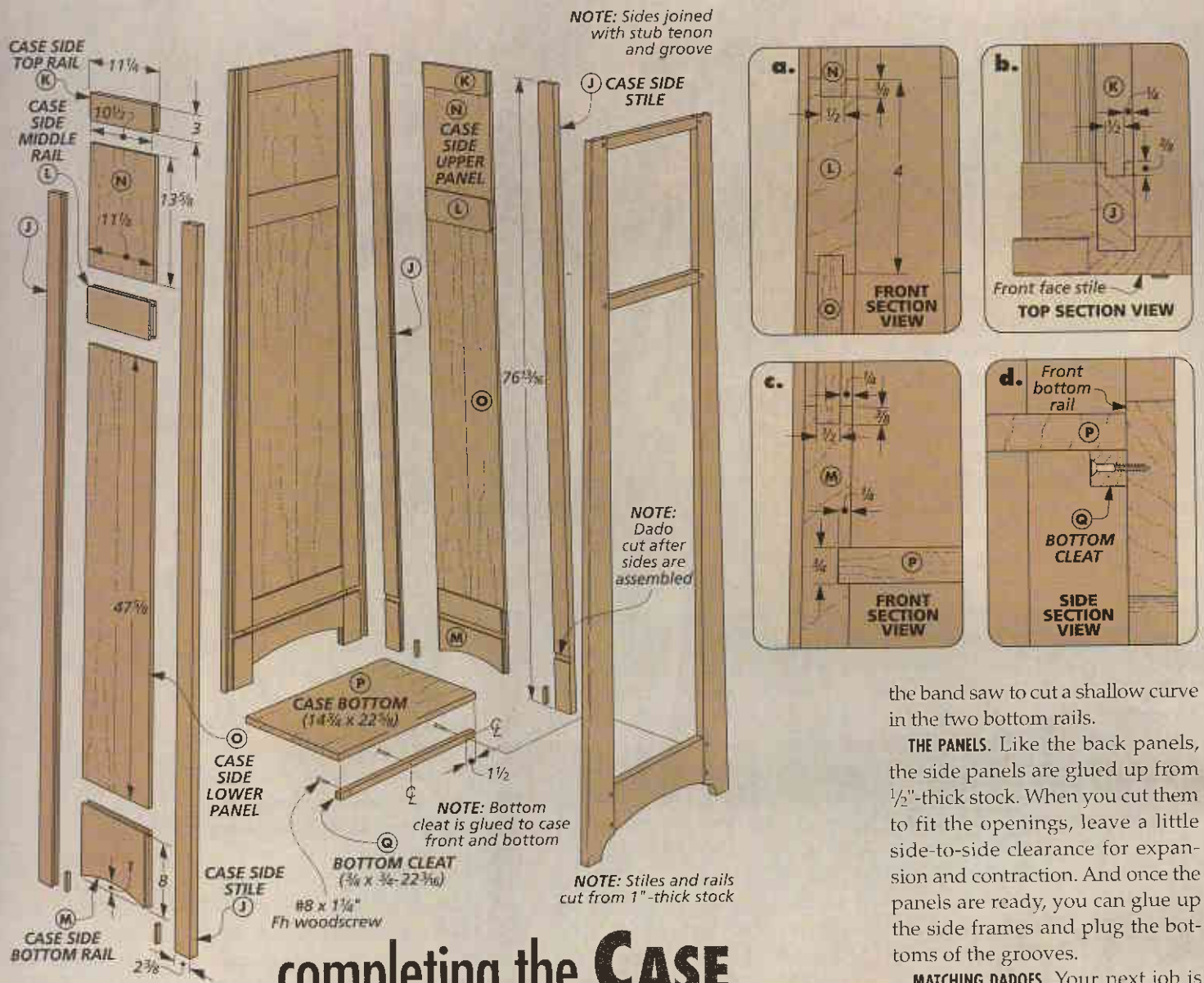
The Mortises. *Cutting the mortises in the front and back stiles starts by drilling out the waste at the drill press.*



The Grooves. *To create the centered grooves in the back stiles, flip the workpiece end for end between passes.*

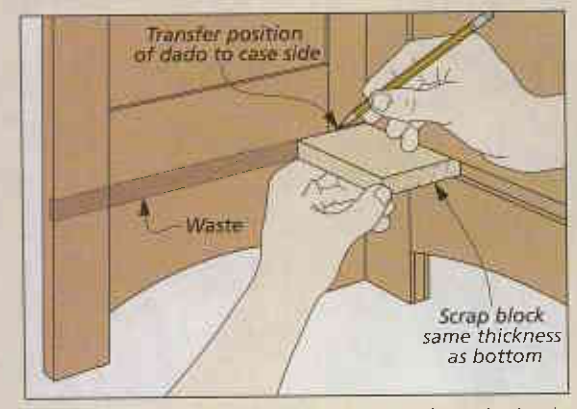


Stopped Dado. *A straightedge clamped to the back frame guides the router when making the stopped dado for the bottom.*



completing the CASE

Shop Tip: Align Dadoes



Perfect Alignment. *With the case side fit to the back, you can use a scrap block to mark the position of the dado for the bottom panel.*

With the front and back ready to go, the next step is to add the two sides and a bottom. The two identical, frame and panel sides are similar to the back. But here you don't have to deal with tapered stiles and the stub tenon and groove joinery I used is a little easier to make. The bottom is simply a glued-up panel.

THE SIDE JOINERY. Once the stiles and rails are cut to size, the side frame joinery goes quickly. First, I cut the centered grooves that will hold the stub tenons and the panels (details above). To complete the job, all you need to do is cut a snug-fitting stub tenon on both ends of each rail. Finally, before starting work on the panels for the sides, I made a trip to the band saw to cut a shallow curve in the two bottom rails.

THE PANELS. Like the back panels, the side panels are glued up from ½"-thick stock. When you cut them to fit the openings, leave a little side-to-side clearance for expansion and contraction. And once the panels are ready, you can glue up the side frames and plug the bottoms of the grooves.

MATCHING DADOES. Your next job is to rout a dado in each side frame to hold the bottom panel. The important thing is that these dadoes line up with the dado in the back panel. The box in the lower corner shows an easy way to get it right.

READY TO ASSEMBLE. The final step before assembling the case is to glue up and fit a solid-wood bottom. Remember, the idea is for it to float in the grooves, so be sure to leave a little front-to-back clearance when you cut it to size.

The grooves in the front and back frames make the case assembly go easy. First, I glued up the sides and the front frame. Then slide the bottom into place and glue it to the front. A cleat between the bottom panel and the front frame reinforces the joint (detail 'd'). And finally, glue the case back to the sides.

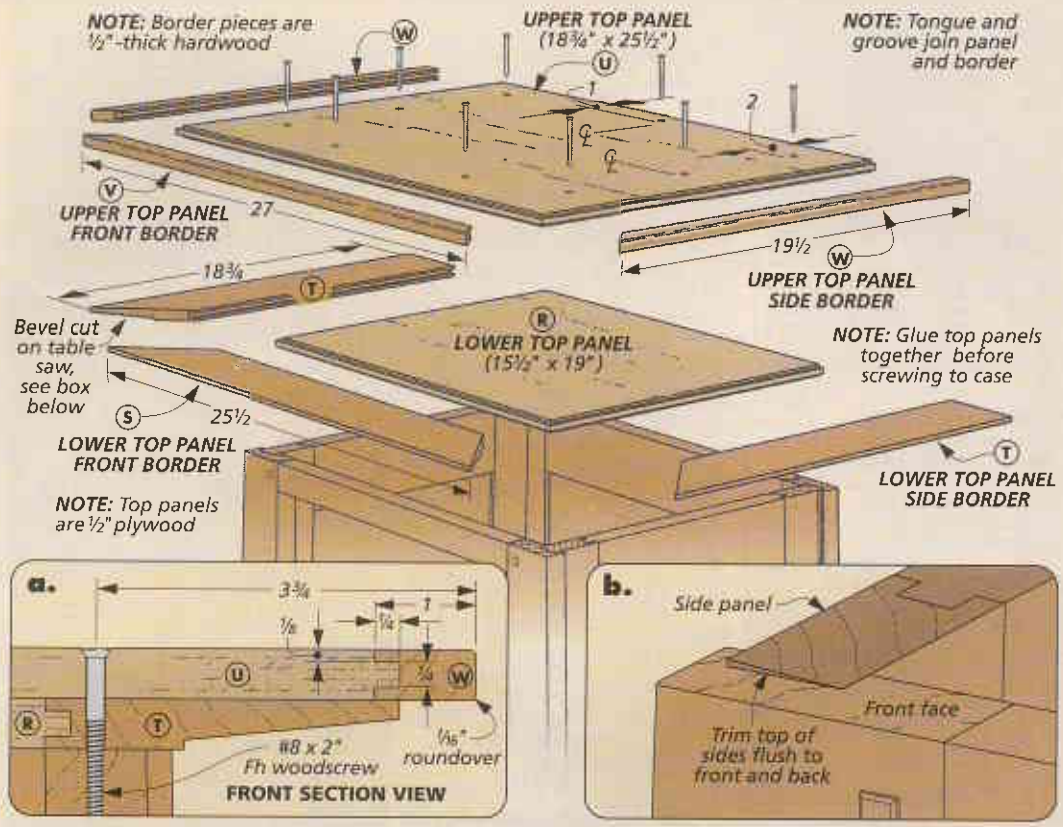
making a Top

With the case assembled, you have something impressive to show for your work. Now you can complete the look by adding just the right Craftsman-style top.

THE GOAL. With its thin profile and wide overhang, the two-layer top is the perfect complement to the tall case. Both layers are made by framing three sides of a plywood panel with a solid-wood border. The border on the lower frame is "lightened" with a classic bevel profile. The upper frame overhangs the lower frame and has only eased edges on the border.

LOWER FRAME. I started with the lower frame. And first off, since the plywood is only ½" thick and the border is fairly wide, it made sense to reinforce the joint between the two with a tongue and groove (detail 'a'). So allow for a tongue on the front and sides of the panel when you cut it to size.

After cutting the tongue on the panel, the three border pieces can be cut to width and rough length and centered grooves cut to fit the tongue on the panel. Next, you can miter the three pieces to fit around the panel. The back ends of the side pieces should be flush with the back edge of the panel.

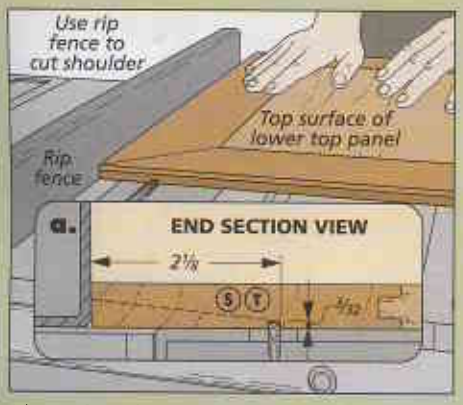


A BEVELED PROFILE. Once the border has been glued around the panel, you can take it to the table saw to add the bevel. The two-step process I used, shown below, gave me a nice, crisp profile. And then a little work with a sanding block will clean up the bevel.

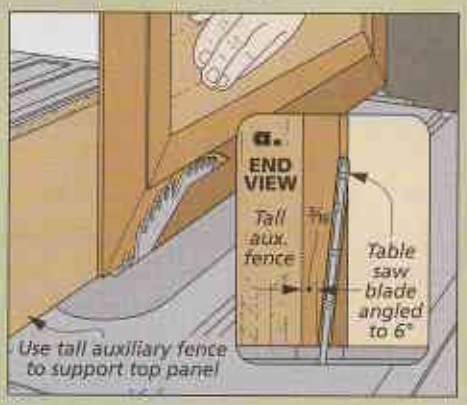
UPPER FRAME. The upper frame takes a little less effort. Here, the border is narrower (1" wide) and the top and bottom edges need only a 1/16" roundover. When the two panels are complete, they're glued together with an even overhang, as shown in detail 'a.'

A LITTLE TRIMMING. Now, before screwing the top to the case, you have a simple task to take care of. Since the sides of the case aren't straight up and down in relation to the front and back, I had to trim the top edge of the sides to create a flat surface for the top (detail 'b'). This shouldn't amount to much. You can use a sharp block plane or just sandpaper and a sanding block to get the job done.

How-To: Create the Beveled Edge

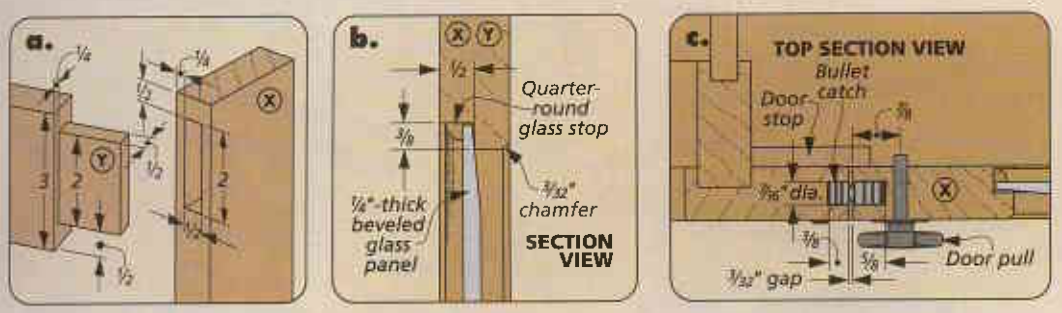


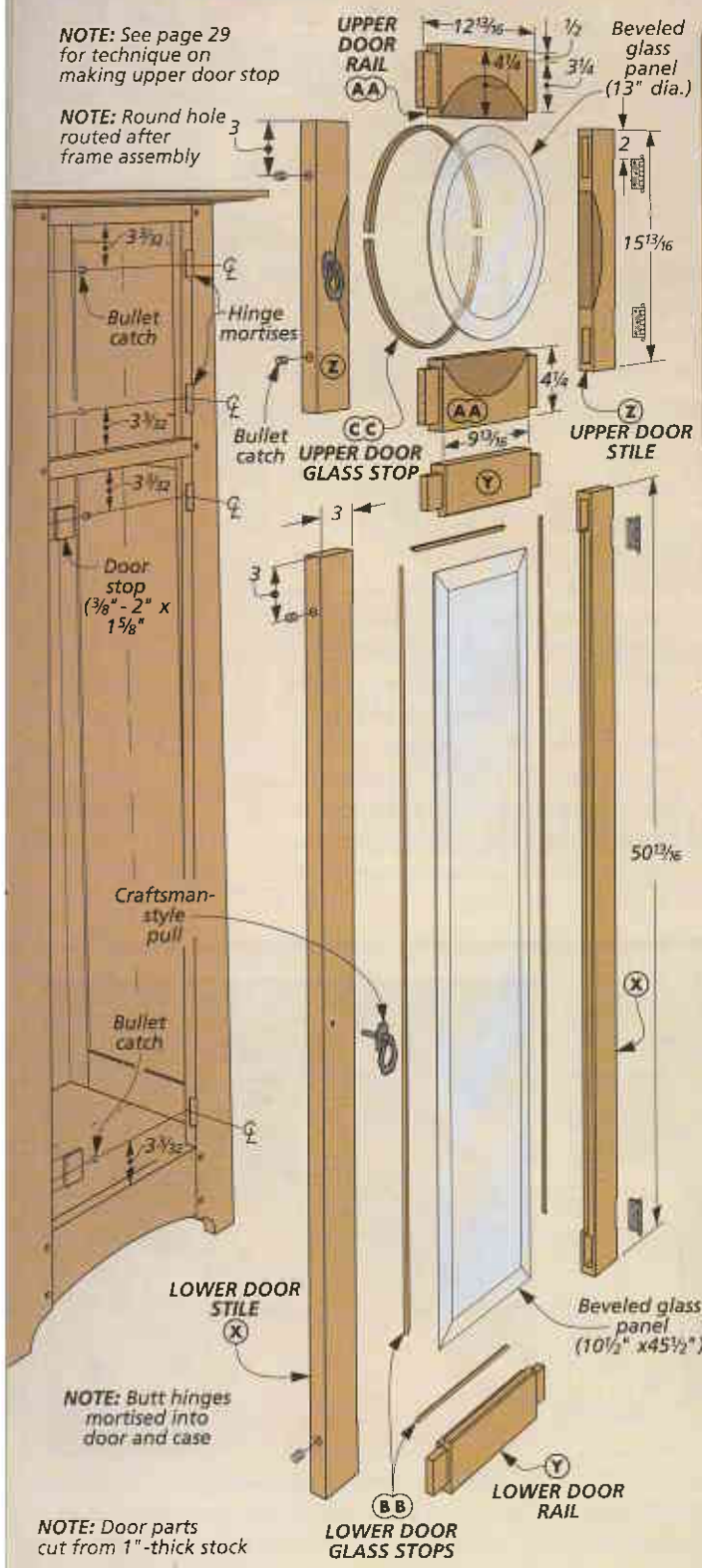
First, the Shoulder. *Start with a shallow cut on the bottom face of all three border pieces to create the shoulder of the profile.*

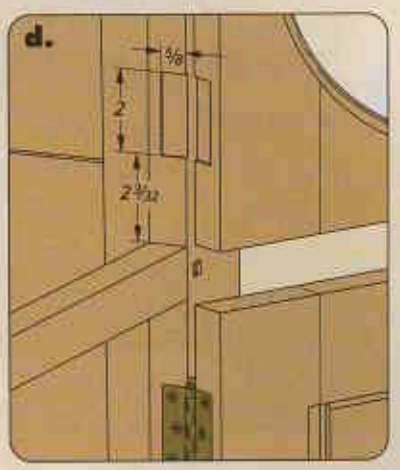


Next, the Bevel. *With a tall fence in place and the blade tilted to 6°, remove the waste with a cut that intersects the shoulder.*

The two-layer top adds a perfect Craftsman detail to the clock case. The simple bevel cut into the lower layer creates a wide, thin profile.







making the DOORS

The case is just about complete. But you'll still need to fill the openings in the case with a pair of inset doors.

As you can see, both the upper and lower door hold beveled glass panels. And you can't miss the fact that both the opening in the upper door and the glass panel are round. The round "porthole" will highlight the the clock face you'll make later. This feature adds an interesting twist to making this door.

THE LOWER DOOR. Before taking on the upper door, I put together the simpler, lower door. The goal was to build a door up to the task of holding a heavy piece of beveled glass. As you can see at left, basic, but very solid, mortise and tenon construction does the trick.

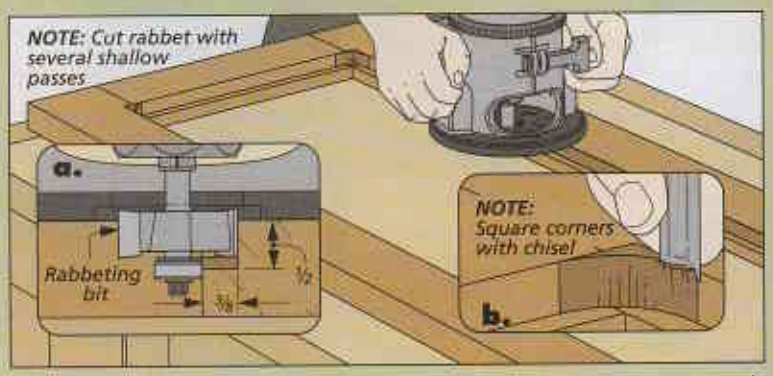
When you cut the stiles and rails to size, allow for a 3/32" gap on all four sides of the door. And then each stile gets a pair of deep mortises and the ends of the rails receive sturdy tenons to match (detail 'a').

FIT FOR GLASS. Once the frame has been assembled, the next task is to adapt the frame to hold a piece of glass. This just involves routing a crisp rabbet around the inside edge of the frame opening (detail 'b'). The box below shows how to do the job with a hand-held router.

A SMALL CHAMFER. One detail remains. You'll want to soften the inside edge of the door frame with a 3/32" chamfer. The chamfer bit will leave rounded corners, but you can easily square them with a chisel.

THE UPPER DOOR. After completing the chamfer, you can set the lower door aside and get started on the upper door. The early stages of the construction here are much the same as the lower door. The first step is

How-To: Creating the Rabbet



First Rout, Then Chisel. *The rabbet that holds the beveled glass is made by taking several, light passes with a rabbeting bit in a hand-held router. The rounded corners left by the bit can be squared with a chisel.*

to assemble a sturdy mortise and tenon frame for the door. But as you can see, the slight difference here is that the two rails are cut a little wider. This extra material allows you to make the circular opening without leaving square corners.

NOW, THE PORTHOLE. Now the interesting work begins. But honestly, you'll find that making the round opening in the door isn't difficult. A router with a sharp straight bit and a simple router trammel turned out to be great way to round off the square opening cleanly, accurately, and without a lot of tedious work.

The drawings and photo at right do a good job of explaining the process. There are two important things to keep in mind. First, you want to make sure the round hole is centered in the frame. This is just a matter of accurately positioning the pivot hole for the trammel.

Next, to end up with a hole that's the right size, the ¼" hardboard trammel needs to be sized accurately. The trick here is simply to choose a router bit (I used a ½"-dia. bit) and then build the trammel to fit it.

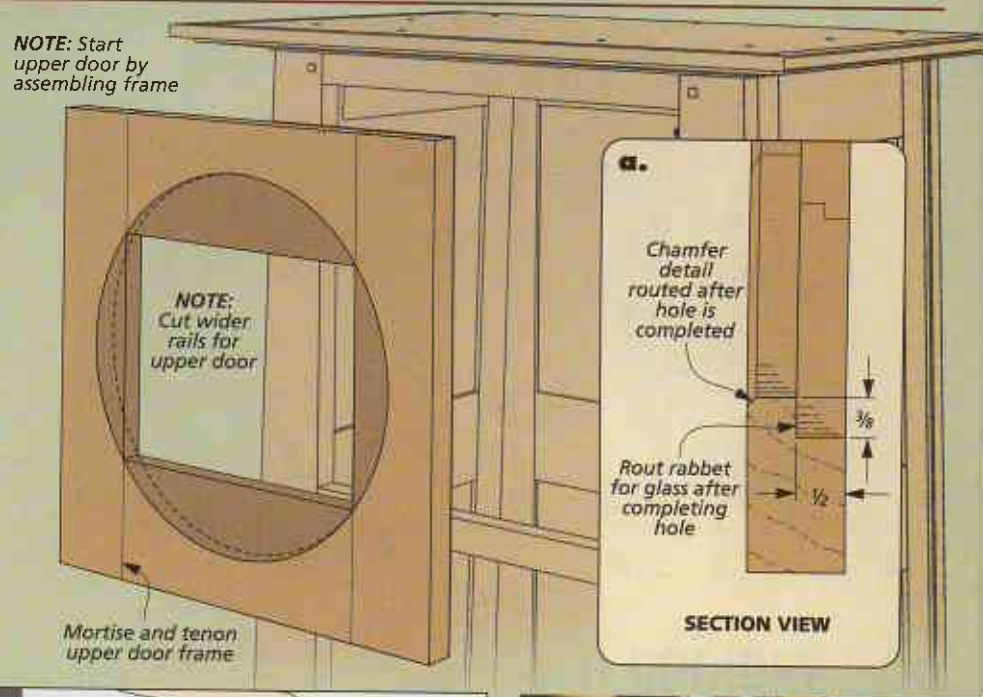
Once the hole is routed, the door frame is finished up just like the lower door. First, rout a rabbet for the glass and then a chamfer around the hole, as in detail 'a' above.

COMPLETE THE JOB. Tying up a few loose ends will complete work on the doors. First, I made and fit some small quarter-round glass stop for both doors. If you're wondering how to do this for the upper door, check out page 29. (Or you can substitute flexible, plastic stop.) But hold off on installing the glass until after the finish has been applied.

All the hardware comes next. I used butt hinges mortised into both the case and the door stiles to hang the doors (detail 'd' opposite). If you have a small router, the mortises can be routed, but I did the work by hand. The article on page 50 gives you guidance here.

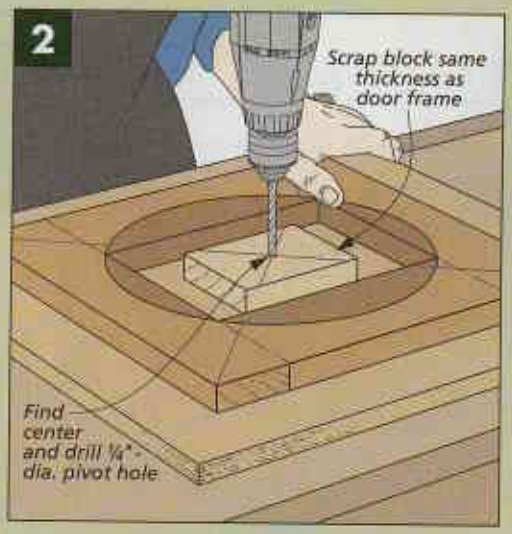
The rest of the hardware consists of pendant pulls to open the doors, bullet catches to hold them closed, and door stops glued to the case to keep everything in line (detail 'c').

How-To: Rout a Round Hole

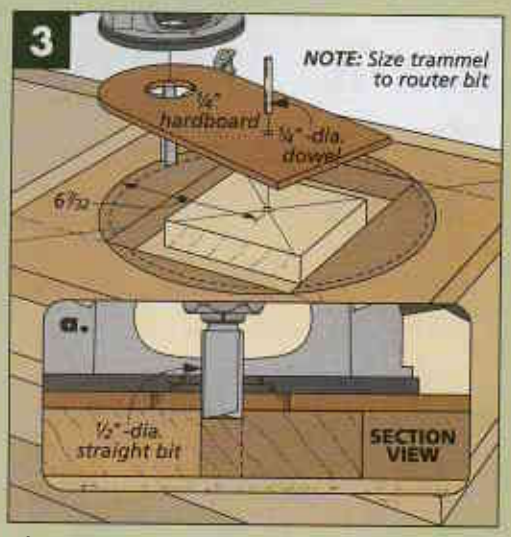


Stuck Down Tight. *To get started on the round hole, clamp a sacrificial piece of plywood to the bench and then firmly carpet tape the door frame to it.*

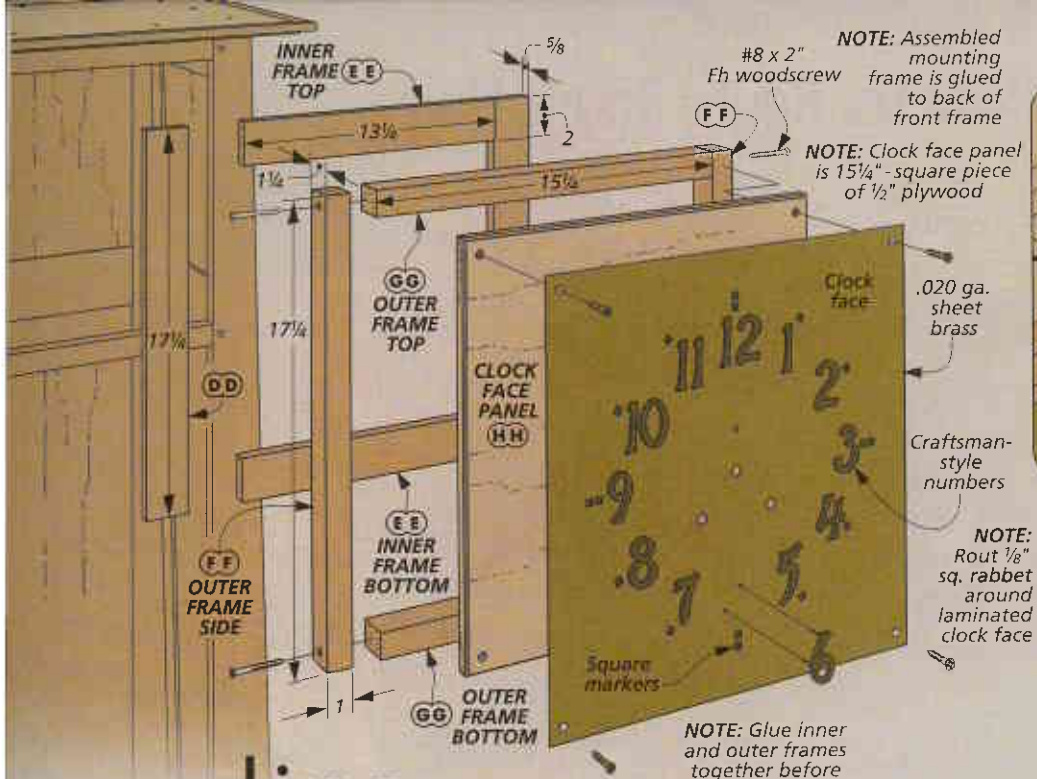
Once everything is set up, the rest is easy. Make shallow passes until the waste is cut free and the hole complete.

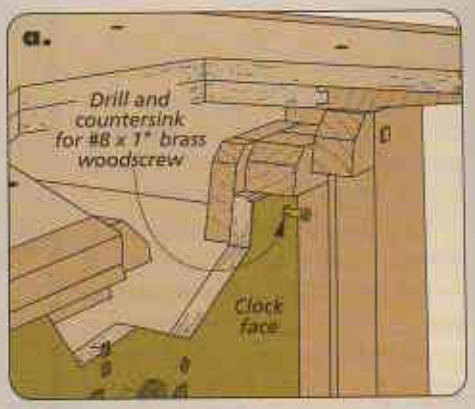


A Centered Pivot Point. *After carpet taping a scrap block to the plywood, draw diagonals to find the center point and then drill a pivot hole.*



The Radius. *When making the trammel, the distance from the outside edge of the bit to the pivot center should equal the radius of the hole.*





making a CLOCK FACE

After hanging the doors, the case looks great, but it doesn't look quite like a clock. So the next task is to transform it by adding a face.

A CRAFTSMAN-STYLE FACE. When making the face, my number one goal was to make certain that its appearance matched the style of the clock case. The effect I wanted for the surface of the face was the rustic, mottled or aged-brass look that you see on old Craftsman metalware. Then some painted Craftsman-style numbers and markers would complete the look. As you can see in the photo on the following page, this combination works pretty well.

A "FACE" FRAME. Before starting on the clock face, you'll need to install a frame behind the upper door opening in which to mount it. The mounting frame is assembled from two "butt-jointed" frames (drawing above). The inner frame overlaps the inside face of the outer frame to create a recess for the face (detail 'a'). You can screw the outer frame together and then glue the pieces of the inner frame to it. Once assembled, the mounting frame is glued to the inside of the case front with an even "reveal" on all four sides.

BRASS OVER PLYWOOD. Now you're ready to start work on the face. The process I used has a fair number of steps, but the upside is that it's not difficult. I got started by cutting a piece of ½" plywood to fit snugly into the mounting frame (drawings above). Then to give myself the appropriate surface to work with, I laminated a sheet of brass over the clock face panel using a spray adhesive (see Sources for sheet brass).

When you laminate the clock face, cut the brass just a hair undersized. This won't be a problem because next you're going to take the laminated panel to the router table to rout a ⅛"-square rabbet around the

How-To: Position the Numbers

A Pattern. *To start making the drilling template, tape a full-size pattern to a piece ⅛" hardboard cut to the size of the clock face.*

Locate the Pin Holes. *Position each number over its place and tap it to mark the spots for the 1/16"-dia. holes in the template.*

Clock Face. *After drilling the pin holes in the template, carpet tape it to the clock face and drill the pilot holes to half the depth of the pins.*

outside edge. Don't worry, light passes with a carbide router bit will handle the soft brass easily.

A CLOCK MOVEMENT. Now, before going any further with the face, you'll want the clock movement you're going to use right at your fingertips. This is because the next step is to drill the holes in the face needed for the movement. As you can see on the pattern at right, mine needed four, accurately placed holes drilled through the brass and plywood.

1 THROUGH 12. After locating the movement holes, next comes positioning the numbers and hour markers on the face. These are held in place by short pins protruding from the backside. These pins need pilot holes and its best to do this work before "antiquing" the face.

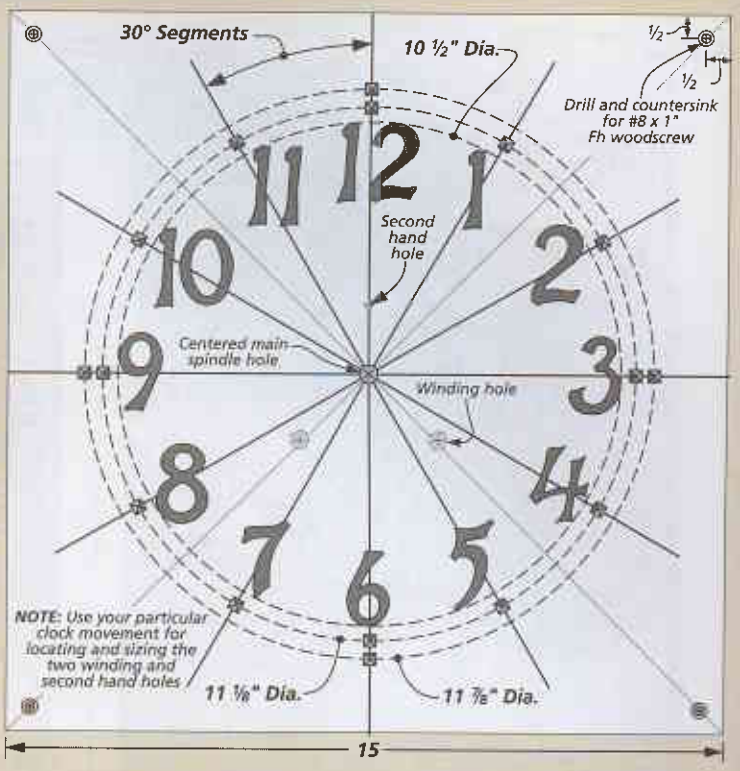
Getting the numbers and markers positioned accurately and the pilot holes drilled in the right spots is the challenge here. The solution is to use a pattern (upper right corner) to help locate the numbers and a drilling template to guide the drill bit. The box on the opposite page shows how to make and use the template.

"ANTIQUE" THE BRASS. With the pin holes completed, you can pull the template off and proceed to age the brass face. The technique I used, shown in the box below, is about as easy as can be. After sanding the brass to an even, dull sheen, you simply roll on a thin coat of mahogany oil stain. The stain can't soak in, so it "beads up" on the surface to give you a great, antique look. The trick is to apply a small amount of stain and keep rolling until you have a consistent appearance.

PAINT BY NUMBERS. Now all you need to do is add the numbers and markers and the hard part of this job is behind you. But you'll want to spray the numbers with a "hammered" effect paint (photo above) before tapping them into place. And after finishing the case and installing the face in its frame, adding the "mechanics" will wrap things up.

To use this pattern to lay out the clock face, enlarged it 400%.

▲ You can use a can of "hammered" effect spray paint to give the numbers a rustic look.

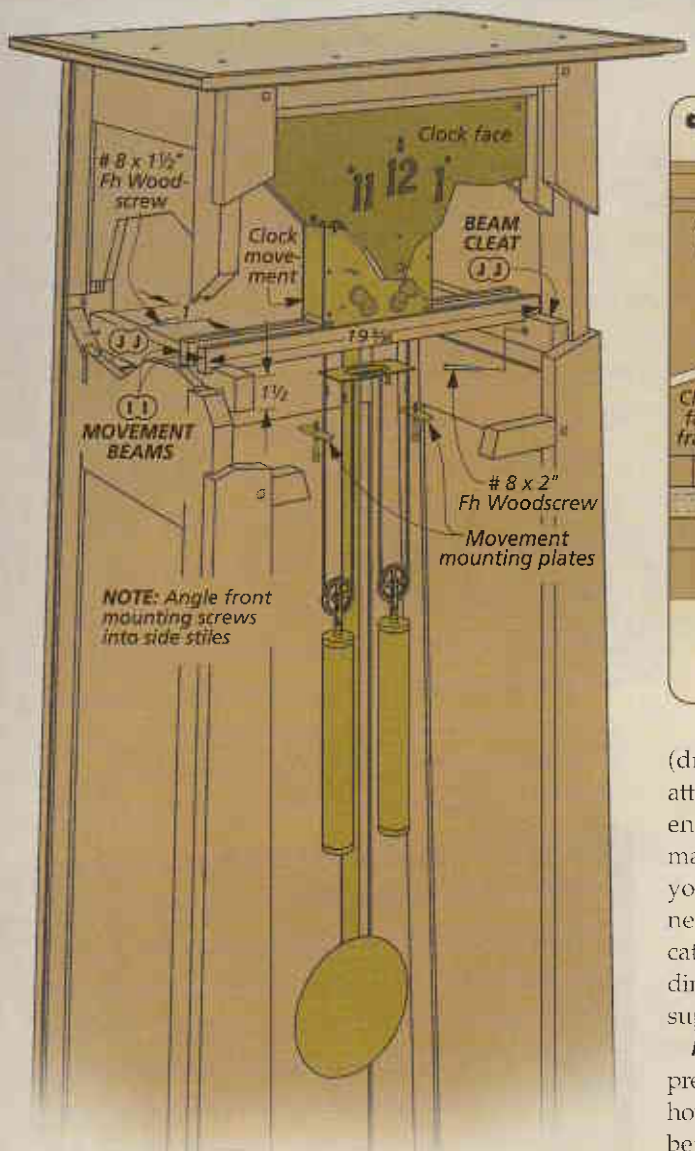


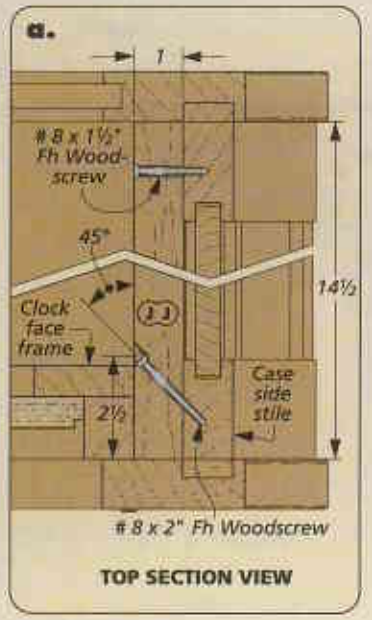
How-To: Turn New Brass to Old

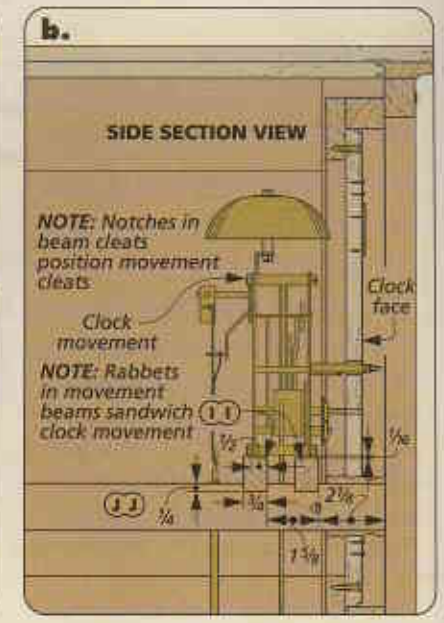
An Evenly Dull Surface. *I used a random-orbit sander to sand the brass with 220-grit and followed with an ultra-fine sanding pad.*

Keep Rolling. *A "dry" coat of stain is what you're after. Apply a small amount and keep rolling until it's spread evenly over the surface.*

Finally, the Numbers. *After the stain dries, spray on a water-based sealer and then tap the painted numbers and markers into place.*







installing the MOVEMENT

The only thing missing now is the traditional pendulum movement. You got a good start on adding the movement by drilling the holes in the clock face to accommodate the stems. But now you need to add a support system for the movement and finally, all the parts.

THE MOVEMENT PARTS. The mechanical movement that I used came with all the necessary parts included: hands, keys, weights, pulleys, and wood stick pendulum. But I had to figure out the best way to install it in the case. And when doing this, there are a couple important considerations.

The mechanical part of the movement isn't very big or very heavy (drawings above). But when you attach the hanging weights to it, you end with a pretty fair amount of mass. This means the supports that you install to hold the movement needs to be sturdy. But there's a catch. The cables and weights hang directly below the movement, so the supports can't block this space.

A SIMPLE SOLUTION. The answer is pretty simple. Detail 'b' above shows how the movement rests on two rabbeted beams. The shoulders of the rabbets sandwich the movement while a couple of bolts through mounting plates snug the movement down to the beams.

The ends of the movement beams sit on notched cleats screwed to the sides of the case (detail 'a'). It's a good, solid way to get the job done, and it's not hard to put together.

THE RIGHT HEIGHT. The only real challenge is getting the beam cleats installed so that the movement stems line up with the holes you drilled in the clock face. The best way to do this is to first make both the movement beams and beam cleats. Then, a little trial and error using carpet tape to hold the beam cleats to the sides will allow you to zero in on the right height.

I loosened the clock face from its frame so I could check my progress. Then with the beam cleats stuck in place, you can set the movement beams on them. Now you can set the movement in place and position the face over it for a test fit.

Once the supports are in place, you can install all the parts and wind the movement. Then with a push on the pendulum, your clock will chime out the hours for years to come. W

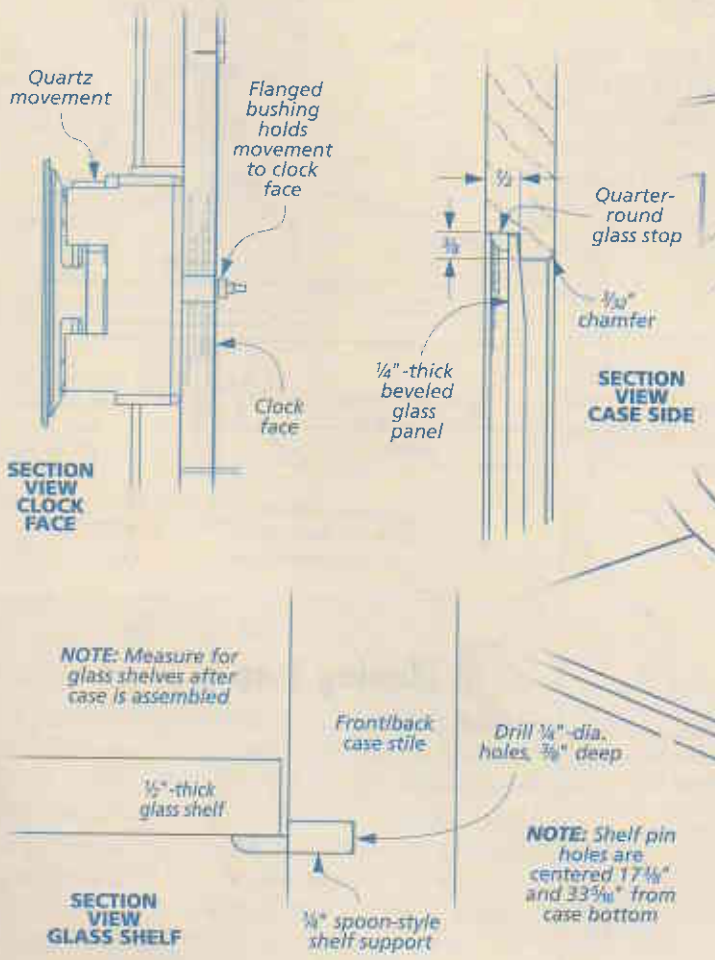
▲ Hanging the weights and the pendulum is the last step. Then wind it up and give the pendulum a nudge.

A Clock and a Display Case

Making this project do double duty as both a clock and a glass-sided display case is a great option. And best of all, the changes are pretty minimal and easy to accomplish.

To substitute beveled glass in the sides, you start by leaving out the lower side panels at assembly. Then you rout away the inside edge of the panel groove to create a recess for the glass. Quarter-round stop, identical to that used in the door, will hold the glass in the sides.

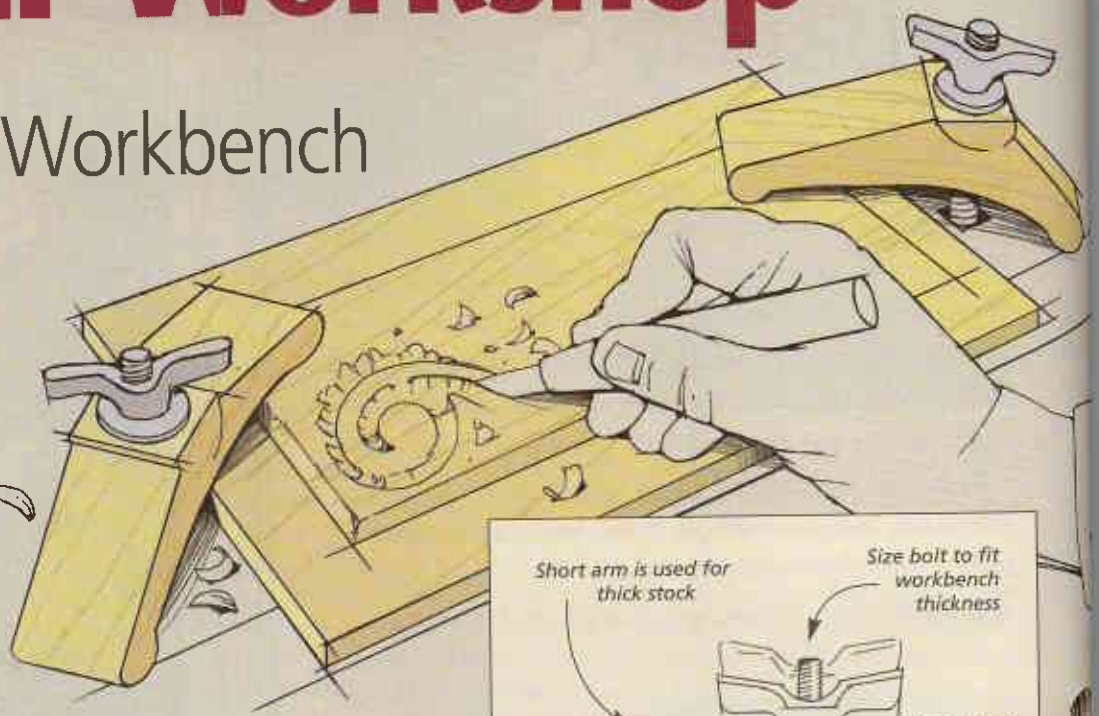
Next, you plan ahead for a couple of ½"-thick glass shelves by drilling shelf pin holes in the case front and back before assembling it. And finally, the display case is completed by installing a quartz clock movement.



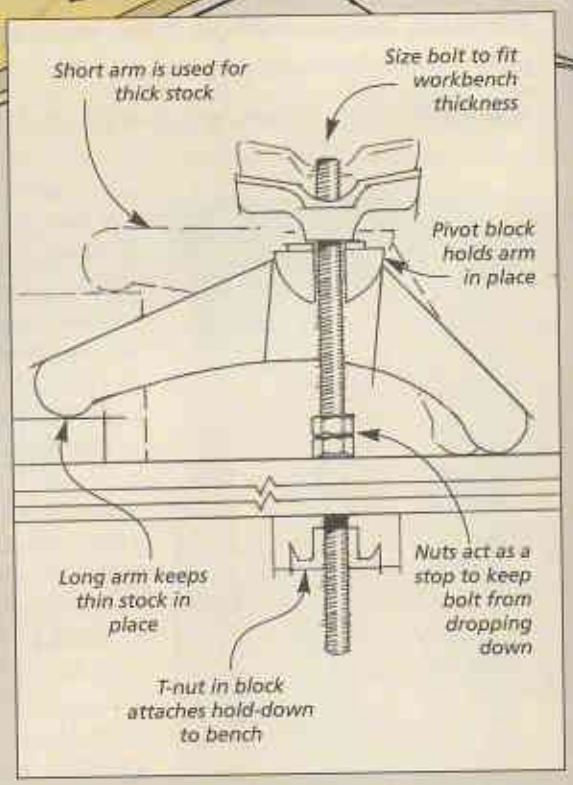
1-Hour Workshop

Our Top 10 Workbench Accessories

These simple, shop-built devices help you get the most out of your workbench.

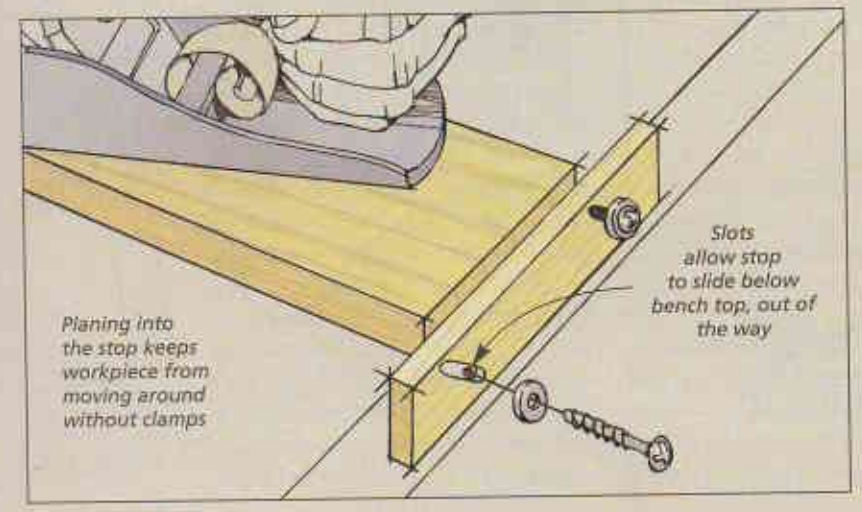


The workbench is the largest "tool" in my shop. And I use it for a lot of tasks. But even the best of tools can benefit from some practical accessories. The ten you see on these pages are the ones I use most often in my shop. Besides making tasks quicker, safer, and more accurate, these simple add-ons can be built with mostly scrap material and in less than one hour. That's more than enough reason to add a few of these to your bench.



1 Hold-Down Clamp

One of the keys to accurate hand work is making sure that your workpiece is held securely. That's where the hold-downs you see in the drawings come into play. Since they're made from wood, they won't mar your workpiece. And a large wing knob makes it a snap to tighten the clamp down or loosen it quickly to reposition the workpiece.



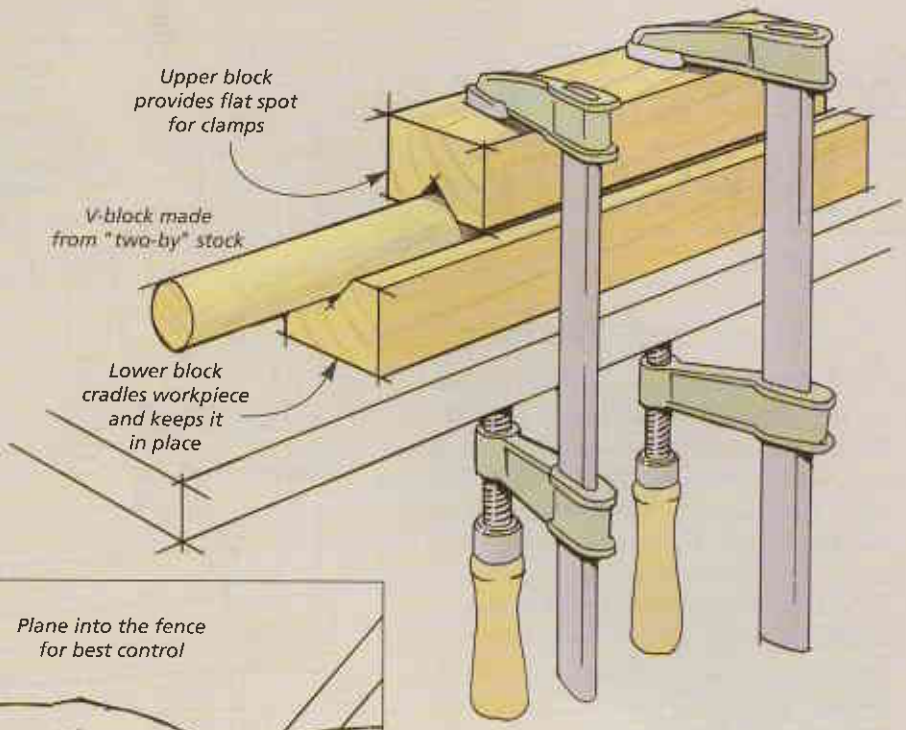
2 Planing Stop

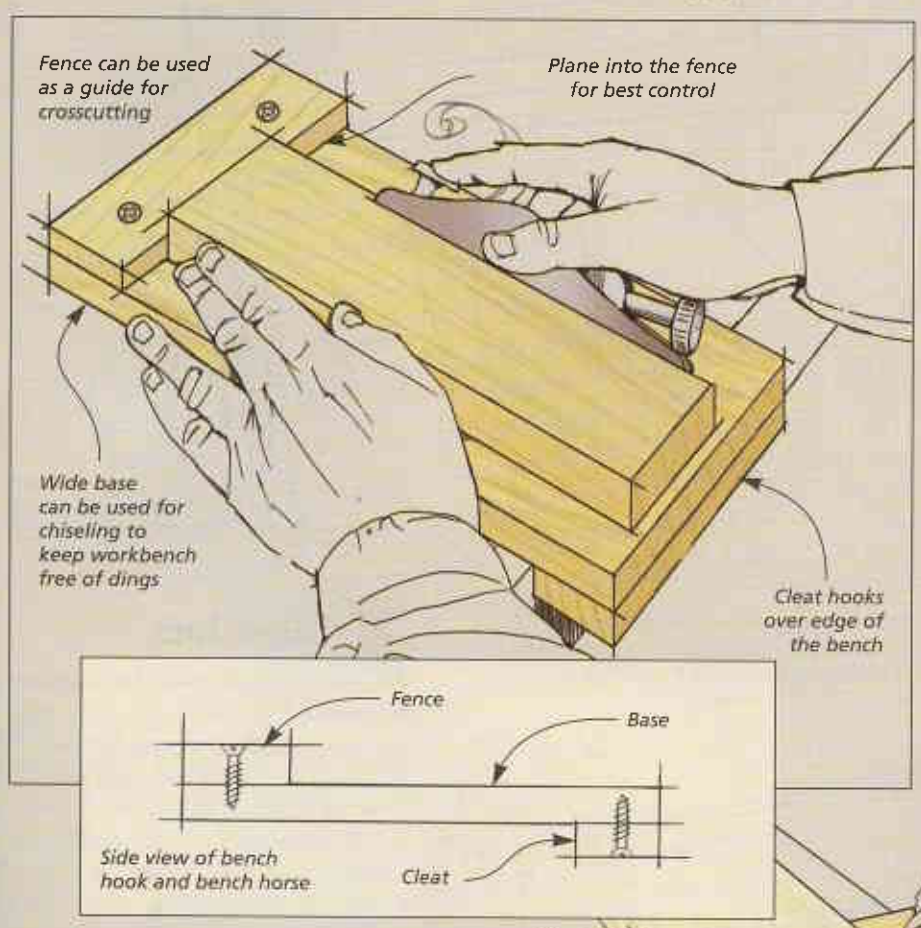
Securing large panels to my workbench for planing or belt sanding was always a bit tricky. Clamps often get in the way of the tool and bench dogs are too narrow to keep the workpiece from shifting. To provide a solid stop for the workpiece, I attached this board to one end of the workbench. A pair of angled slots in the stop allow it to slide below the worksurface when it's not needed. A couple of screws anchor it in place.

3 V-Block

The large, flat surface of my workbench is perfect for most of the work I do. But clamping a round or odd-shaped workpiece to the benchtop can seem more like trying to hold onto a wet bar of soap.

To make it easier to grab and hold these pieces, I turn to the simple, two-part V-block you see here. I made mine from a section of "two-by" stock. The base can be any length, but I found 12" to be about right. It provides a stable, wiggle-free platform for drilling, shaping, or smoothing. A shorter top piece gives the clamps a flat spot to lock the part in place without marring it.





4 Bench Hook

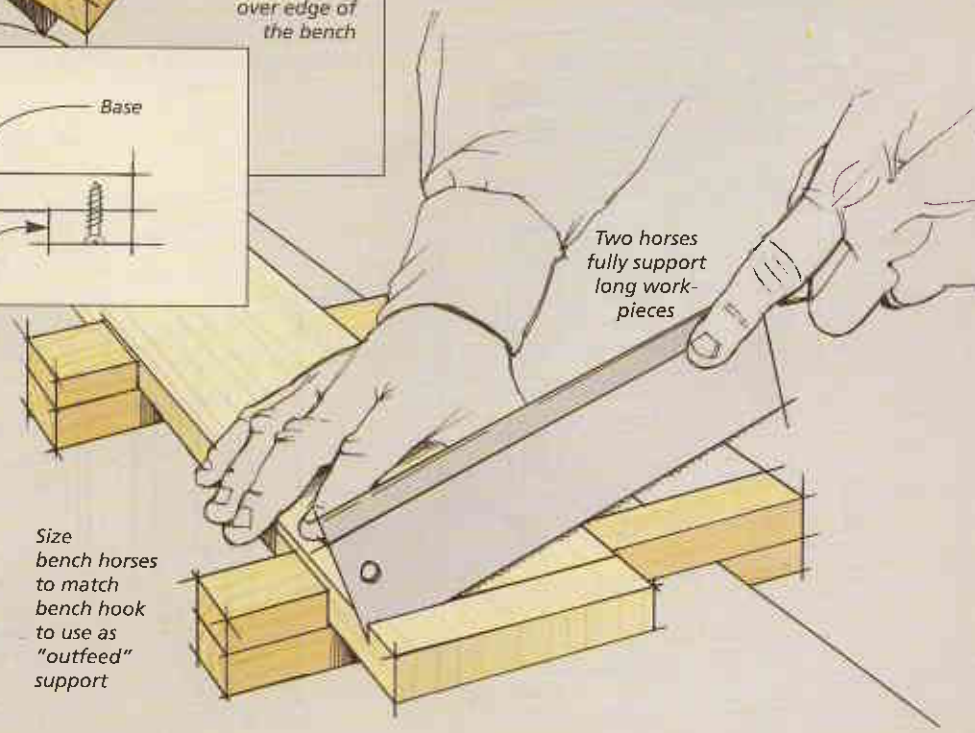
This is one bench accessory that I always keep close at hand. I can use it as a guide for quickly cutting parts to length or as a planing stop for small parts, as you can see in the drawing at left. The base also protects the bench from sharp chisels and carving tools.

The bench hook is made up of a wide plywood base with a thick hardwood fence at the back and a cleat along the front edge to catch on the edge of the workbench.

5 Bench Horse

I like to think of these narrow bench hooks as benchtop saw horses. They raise a workpiece high enough off the benchtop to crosscut the end without damaging my bench. I also use them for trimming tenons.

It's a good idea to make at least two so you can support long stock. I made mine the same depth as the full-size bench hook shown above. This way, they can serve as "outfeed" support so long workpieces won't sag.



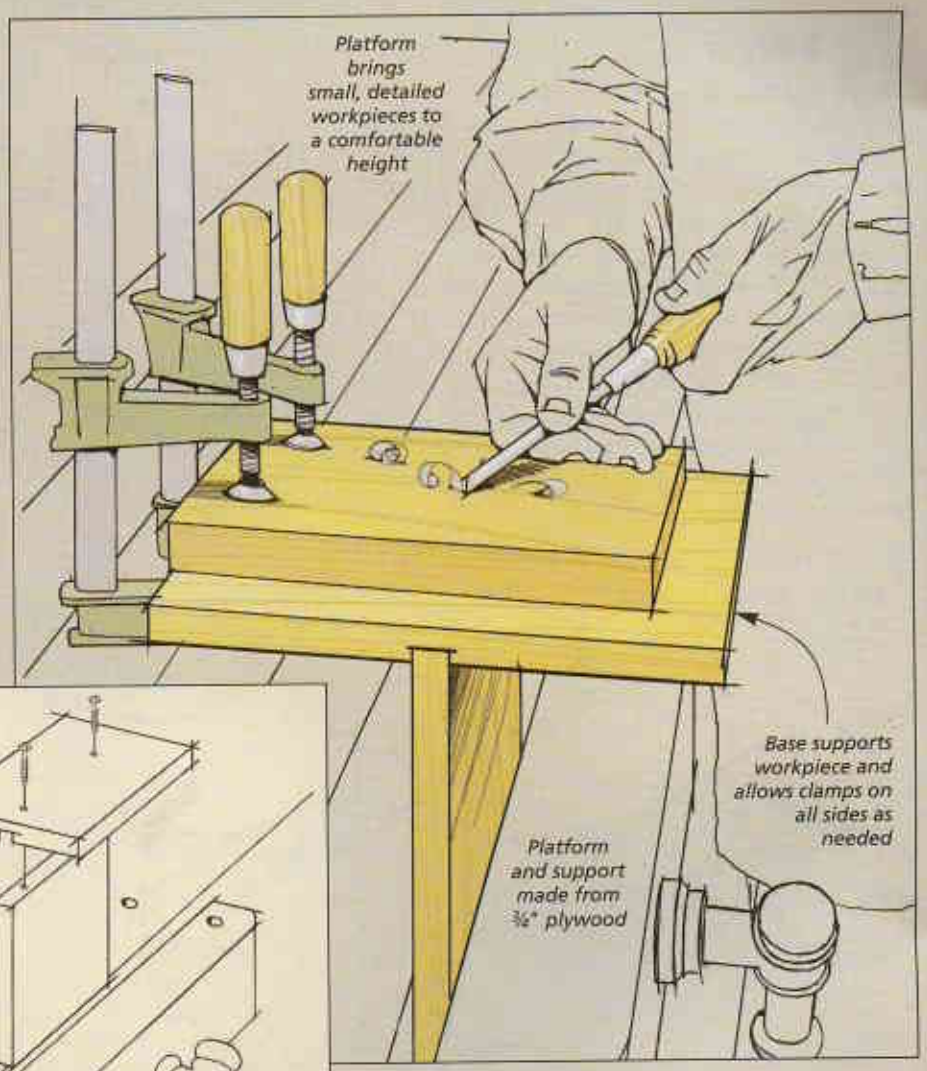
accessories for the BENCH VISE

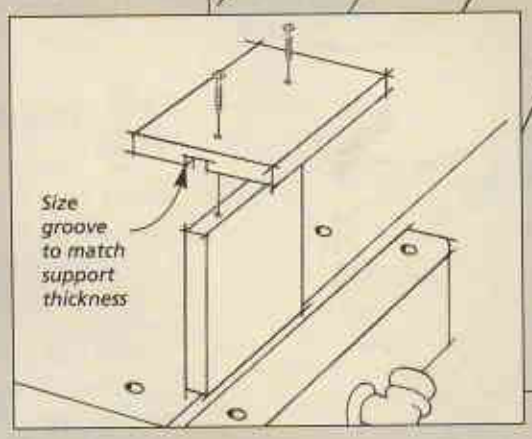
6 Small Parts Platform

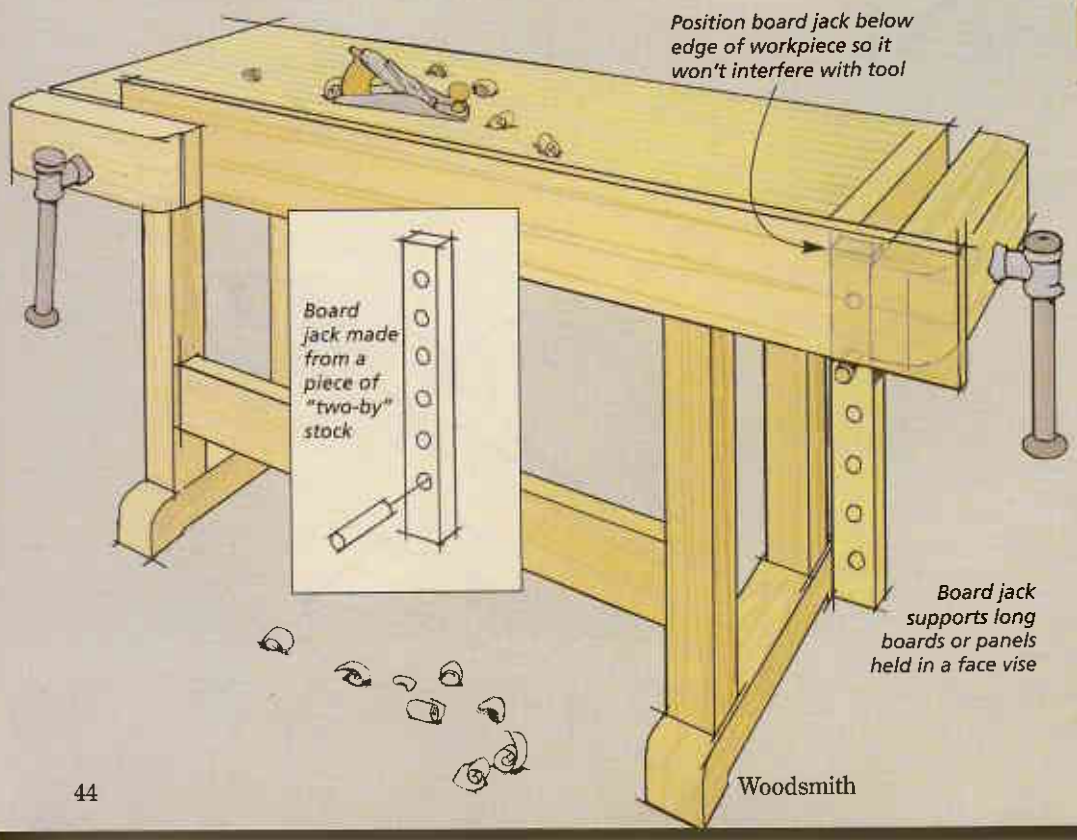
Hunching over a bench while working on a small workpiece is a good way to get a back ache. And securing a small, thin part to a large workbench top can be another problem. But the solution to these two problems is a plywood platform that couldn't be simpler to make.

The plywood top is small and thin enough to securely clamp a workpiece on all four sides for carving, or other close-up work. I've also found this platform comes in handy as a small parts assembly table.

The raised platform at right is just two small pieces of plywood joined into a "T" shape with a dado and some glue and screws. Just be sure the bottom leg of the "T" is long enough to bring the platform up to a comfortable working height when it's clamped in a bench vise.







7 Board Jack

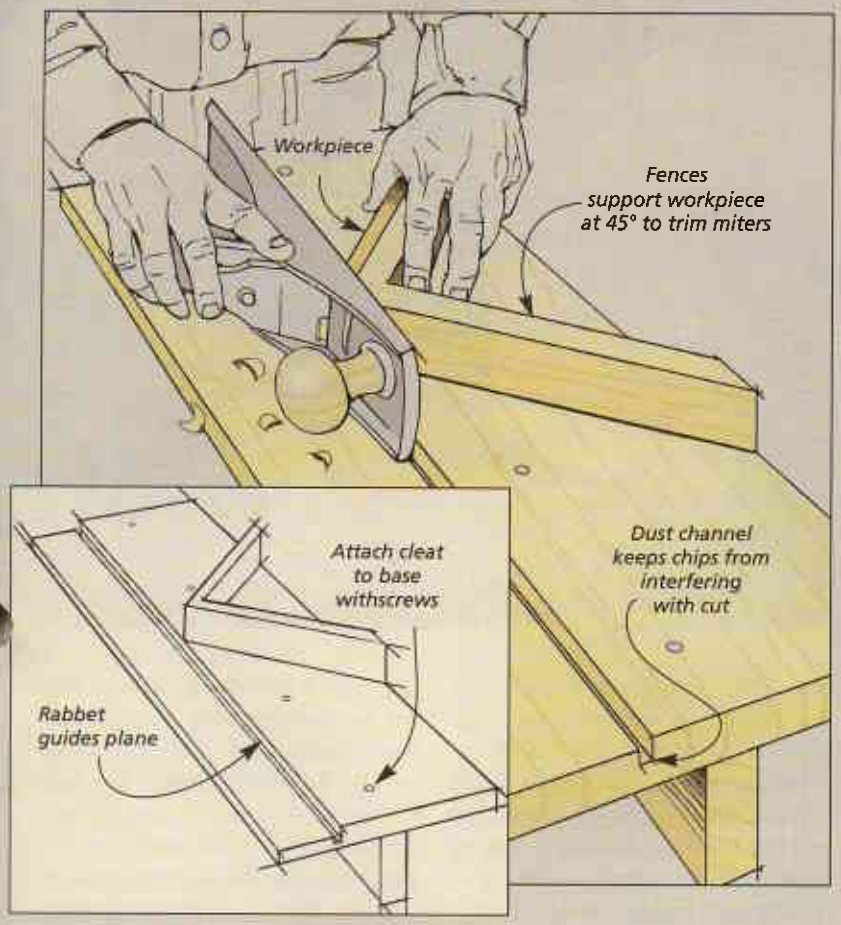
Like small parts, clamping and supporting long boards or wide panels to a workbench can pose some challenges. Especially if you need to work on the edges of these pieces.

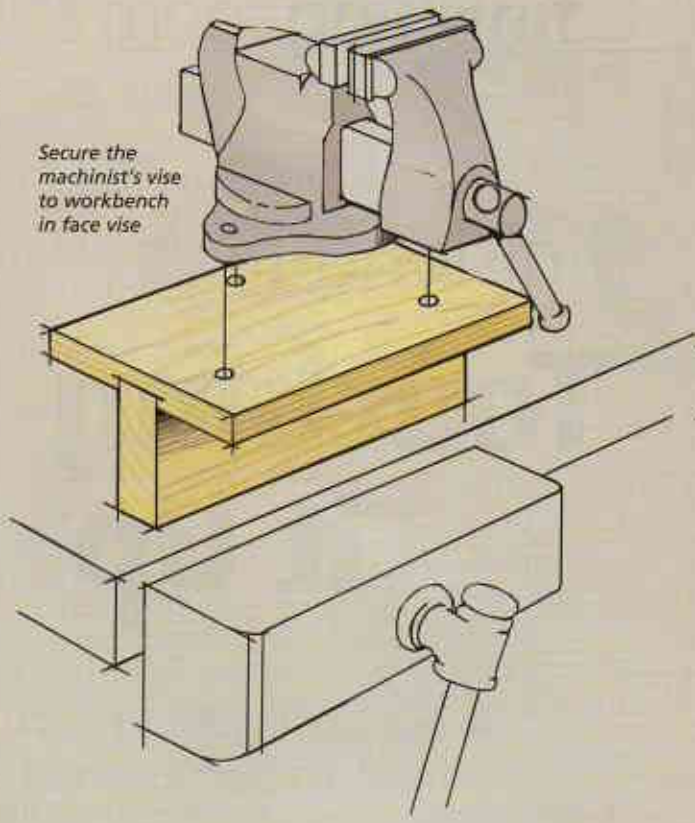
The solution I use isn't really new. In fact, it's been used by woodworkers for hundreds of years. It's called a board jack. (Although some people call it a "sliding deadman.")

As you can see in the drawing at left, the board jack supports the opposite end of a long workpiece while it's clamped in the face vise. Although some board jacks are permanently attached to the workbench, mine is just a board that gets clamped in the end vise. A row of holes drilled along the length and a short wood peg make it easy to adjust for the width of the board or panel.

8 Miter Shooting Board

A poor-fitting miter joint on a project sticks out like a sore thumb. However, trimming it to fit tight on the table saw or miter saw can be a challenge. That's when I like to turn to a sharp hand plane and this miter shooting board. With the shooting board, I can hold the workpiece firmly against the angled fence. Then I can trim a bit at a time to sneak up on the fit. The plane is guided by a wide rabbet cut in the edge of the base. A pair of fences attached to the base allow you to trim right or left miters.





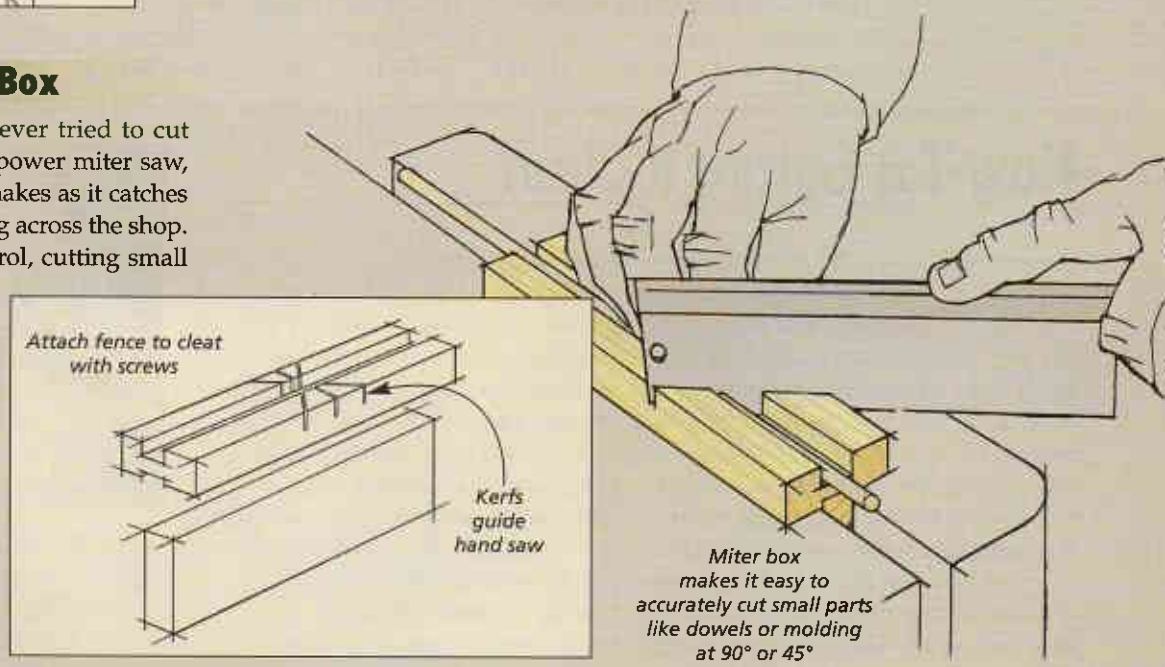
9 Add a Machinist's Vise

While I work with wood most of the time I'm at my bench, there are times when I need to cut, file, or shape metal. For that, a machinist's vise comes in pretty handy. But I don't want or need it on my bench all the time. To make for easy use, I bolted the vise to a plywood base that has a cleat on the bottom. The cleat gets clamped in the face vise of the workbench and holds the metal vise steady as a rock.

10 Mini Miter Box

Zing! If you've ever tried to cut small pieces of molding on a power miter saw, you know the sound a piece makes as it catches on the blade and goes whistling across the shop. Besides being difficult to control, cutting small parts on the miter saw can sometimes lead to tearout and rough cut edges.

A cleaner and safer way to make those cuts is to use a hand saw and the small miter box you see in the drawing at right. It clamps securely in a bench vise. A kerf for 90° and left and right 45° cuts in the fence guides the saw for smooth cuts every time.



finishing fixes

Touching It Up

In many cases, all it takes to make a project look new again is a little "touch-up."

It doesn't seem to take long before a project I've built or a piece of furniture I've purchased starts showing some tell-tale signs of use — usually in the form of a few scratches here and there. Or the edge of a table top or leg starts to look "lighter" than the rest of the piece where the color has worn away.

Although it's frustrating, I've learned to accept it as part of life. The nice thing is these minor problems are easy to fix with nothing more than a touch-up pen (photo above).

TOUCH-UP PENS. Touch-up pens aren't a whole lot different than the colored markers you've probably used as a kid (see upper right photo on opposite page). About the only real difference is the color choices you'll find. They're "matched" to the typical woods and stains used for furniture projects. (For sources, turn to page 49.)

GETTING STARTED. One of the first things to do before you uncap a pen and get to work is to give the project a thorough cleaning (see the box below). A good cleaning will let you know exactly what areas really need work.

How-To: Getting It Clean

The one rule I follow before attempting any "repair" is to clean the project first.

Mention "cleaning" and most people get out the soap and water. But that's really a last resort. Instead, I start with a solvent, like the naphtha you see in the photo at right. It dries quickly and it's safe for most finishes. (As always, test it in an inconspicuous spot at first, just to be on the safe side.)

If you find that the naphtha doesn't remove all the grime, you can give soap and water a shot. For this, I mix a little soap into a bucket of water. Starting with a clean cloth, dip it into the water and wring out any excess. The goal here is to use as little water as necessary to clean up the project — you don't want to soak the wood.

Once you have the dirt, wax, and greasy smudges removed, you may find even more areas that need work. But don't worry. Now you know exactly where the problems are — and how much work it's going to require to take care of them.

▲ Before you begin any work, the first step is to clean the project with naphtha and a soft cloth. This solvent dries quickly and won't damage the existing finish or the wood.

"HIDING" THE PROBLEM. The secret to using a touch-up pen is to avoid trying to fix a big problem like a deep gouge or scratch. No matter what you do, the problem is still going to stick out like a sore thumb.

A touch-up pen is really only for minor scratches, scrapes and worn areas in both the finish or the wood. These types of problems are much easier to "hide."

You'll notice I said hide not eliminate. The real goal here is to camouflage the problem area and minimize any contrast so that it doesn't stand out when someone looks at it. In fact, once you're done, you may be the only one who really notices what's been fixed.

MATCHING THE COLOR. To accomplish this, you need to overcome one challenge — selecting a touch-up pen color that matches the problem area. To get the best results, I've learned *not* to go by the color described on the pen.

Manufacturers give their colors nice-sounding names like "natural oak" or "red mahogany" that seem like they should match perfectly. But in reality, you may find out that "pecan medium brown" is a better match for your stained oak project. So what do you do to avoid using the wrong color?

I find it best to try the color in an inconspicuous spot to see how close the match is. This way, if the color isn't right, I can try something different without creating a bigger problem. Another handy way to get a good starting point is to collect all your touch-up pens and make a "cheat sheet," as in the box at right.

WORKING WITH A TOUCH-UP PEN. Once you have a good color match, the hardest part of working with a touch-up pen is over. All that's left to do now is "hide" the problem area by drawing in a little color, like you see in the center photos at right.

To get the best results, you'll want to keep a couple things in mind. First, always start lighter in color. A lighter "repair" is less likely to catch the eye than one that's too dark.

If the area ends up too dark, grab a clean cloth and dip it in some alcohol. Then wipe the area to "pull" some of the color back out.

Touch-up pens come in a wide range of colors and different tip styles. Art stores feature touch-up pens (top) with fine, medium, and wide tips in a single pen.

Another thing to keep in mind is that you can mix and match colors to get the shade you need. Simply apply one color and then once it dries, go back over the area with another color. Here again, it's best to try this in an inconspicuous spot.

Most touch-up pens have big, wide tips. This works great along an edge that needs color, like the chair leg on the opposite page. But a wide tip can make it tough to do detail work. To solve this problem, stop at an art store. They have artist's pens that feature different tip styles along with a wide range of colors. You'll still have to decide on the right match to fill in the missing color.

And that's really the main goal. Add a little missing color to disguise the problem. Once you've done that, you'll be the only one who really knows.

A surface scratch like the one in the left photo is an easy fix with a touch-up pen. Using a touch-up pen with as fine a tip as possible, fill in the areas by dabbing along the scratch (center). You may need to let the area dry and then go back over the area lightly to even out the color until the scratch is barely noticeable, like you see in the photo at right.

Shop Tip: Matching Colors

Touch-up pens are a great way to make a quick fix on a project. Unfortunately, picking the best match between my set of pens and the project is often a trial and error process.

To solve this problem, I created a "cheat sheet" by coloring in some samples on a piece of acetate (a plastic film used for overhead presentations). Be sure to write the name of the color by each sample. When you need a starting point, simply hold the sheet up next to the project and choose the best color match.

Questions & Answers

Cutting Dadoes in Plywood

Q ***It seems that every time I cut dadoes in plywood they end up too loose and never fit well. Is there anything I can do to get a better fit?***

Mark Phipps
Wichita, Kansas

A Cutting dadoes always appears easy. Just set your dado stack to the width you want and make the cut.

The problem is, it's never that easy. Quite often, the cut ends up being a bit too wide leaving you with a loose-fitting joint. But there are things you can do to get a dado joint that fits better.

MEASURE CAREFULLY. One of the most common causes of loose dadoes is failing to measure the exact thickness of the material that fits into the dado. Sheet goods, such as plywood, are usually a bit thinner than the thickness listed in the store. And you'll find the thickness can vary throughout the sheet. So if you buy a piece of 3/4" plywood and then cut a 3/4" dado, you'll almost always end up with a poor fit.

So any time you're building a project using man-made materials, like plywood, you'll want to carefully measure the actual thickness of the material. This way, you can set the dado stack to that exact thickness. And it's always a good idea to make a few test cuts just to be sure.

TECHNIQUE. Because the thickness of plywood varies, you might want to consider a technique that won't require you to match the dado stack to the exact thickness of the plywood. A good way to do this is to "sneak up" on the cut.

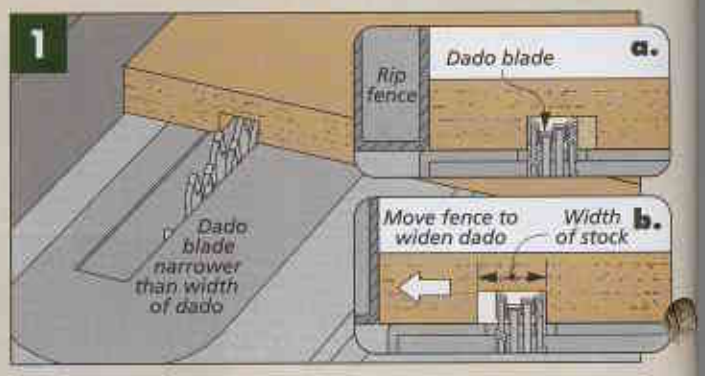
This technique is quick and easy. The first thing you'll want to do is to set up the dado stack so it's narrower than the width of the dado you want to cut, like you see in Fig. 1.

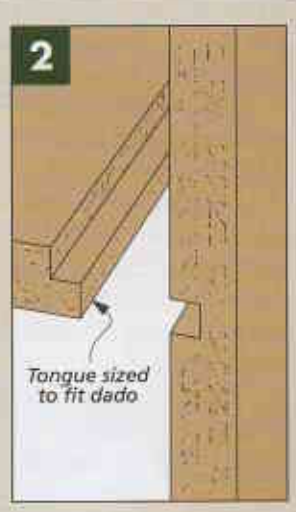
Next, make one pass along you layout line (see detail 'a'). Then, after your first pass, move the fence over and make additional passes until you reach the final width (see detail 'b').

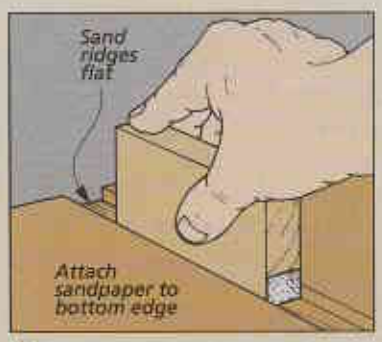
FLAT BOTTOM. Regardless of how you make the cut, you'll often find ridges at the bottom of the dado. It's a good idea to smooth out these blade marks. This ensures the joint will fit as tight as possible.

To do this, I like to use a sanding block, like you see illustrated at the lower left. It only takes a few quick strokes to smooth the bottom for a good fit.

ALTER THE JOINT. A final thing you might consider is cutting a tongue and dado instead of a full dado. This strong joint, like you see in Fig. 2, is easy to cut and it eliminates the need for matching the thickness of the stock. It also hides any chipout that might be present along the joint. W







▲ *To get a flat bottom in the dado, use a block that's slightly thinner than the width of the dado to sand it smooth.*

Do you have any questions for us?

If you have a question related to woodworking techniques, tools, finishing, or hardware, we'd like to hear from you.

Just write down your question and mail it to us: Woodsmith, Q&A, 2200 Grand Avenue, Des Moines, Iowa 50312. Or you can email us the question at: woodsmith@woodsmith.com.

Sources

GRANDFATHER CLOCK

One of the things that gives the grandfather clock on page 30 its great look is the hardware that's used. The 2" ball-tipped butt hinge (PB-407B), pendant pull (MS-14), brass ball catches (BC-275), and the upholstery tacks (T-5) used for the clock face markers all came from *Horton Brasses, Inc.*

To make the face of the clock, you'll need a piece of .020" brass plate. The piece of brass plate (#8956K73) I used was ordered from *McMaster-Carr.*

The doors of the clock call for a couple of pieces of beveled glass. I ordered the glass I used at a local glass store. If needed, *Rockler* has flexible quarter-round glass stop (#34748).

One of the more important items you'll need is the clock movement. I used a *Kieninger* mechanical clock mechanism (#084103) that I ordered from *S. LaRose.* It came complete with hands, cables, weights, shells, pulleys, key, and a stick pendulum with a brass bob. The set of clock face numerals (#085778B) came from *S. LaRose* as well. And you'll need a can of *Rust-Oleum* hammered finish spray paint for the numerals.

If you build the display case clock, you'll need a different clock mechanism. For this, I used a quartz movement (#812174) that I ordered from *S. LaRose.* Again, the ½"-thick glass shelves were ordered from a glass store.

ONE-HAND CLAMPS

One-hand clamps, like those featured on page 10, can be real time-savers. The *Professional Diamond* clamp (#31691) and the *Variable Ratchet* clamp (#31591) are made by *Craftsman,* and I picked them up at a local *Sears* store.

You'll find the *Pony Spring Clamp* (#3202), *Adjust-a-Clamp* (#3250), and *Pressure Adjusting Clamp* (#32225) at home centers and from the *Adjustable Clamp Company.* You'll be able to find the *Irwin Spring Clamp* (#222702) and *Irwin Quick Grip Hand-Clamp* (#59200) at many home centers and hardware stores as well. Most of these clamps, including the *Bessey Varioclippix Clamp* (XV5-100), are available at the *Woodsmith Store.*

STORAGE CHEST

Most of the items you'll need to build the storage chest on page 20 can be found at your hardware store or home improvement center. One thing you'll need is a pair of flat springs to keep the tilt-out bin from slamming closed. The flat springs (FS-08) I used were ordered from *Small Parts, Inc.*

SERVING TRAY

You won't need any hardware to build the serving tray on page 16. But I did add a design to the *Plexiglas* tray bottom by using decorative window film that I ordered from *Glass Decor and More.* You'll find a variety of designs available.

TOUCH-UP PENS

When it comes to the touch-up pens on page 46, you'll find a number of products available. *Pantone* and *Prismacolor* pens can be found at most art stores. The *Pro-Mark II* and *Behlen Furniture Scratch Remover* pens were ordered from *Mohawk Finishing Products.* They come in a wide range of colors. You can find distributor information in the margin at right. These touch-up pens are also available at the *Woodsmith Store.*

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MAIL ORDER SOURCES

Similar project supplies may be ordered from the following companies:

Woodsmith Store
800-444-7527
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Bessey Clamps, Flush-Trim Bits, Glass Stop, One-Hand Clamps, Miller Dowel System, Pony Clamps, Touch-Up Pens

Rockler
800-279-4441
rockler.com
Bessey Clamps, Flush-Trim Bits, Glass Stop, Miller Dowel System

S. LaRose
888-752-7673
slarose.com
Clock Movements, Clock Face Numerals

Horton Brasses, Inc.
800-754-9127
horton-brasses.com
Ball Catches, Butt Hinges, Pendant Pulls, Upholstery Tacks

Adjustable Clamp
312-666-0640
www.adjustableclamp.com
Pony Clamps

Small Parts, Inc.
800-220-4242
smallparts.com
Flat Springs

Miller Dowel Company
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Glass Decor and More
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Irwin Industrial Tools
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irwin.com
Quick-Grip Clamps

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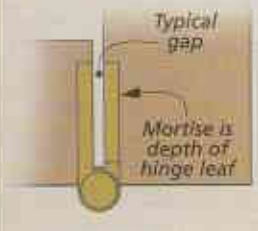
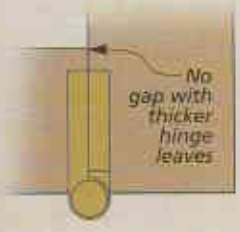
no fuss Hand-Cut Hinge Mortises

Creating hinge mortises by hand is easier than it looks — all it takes is a sharp chisel, a steady hand, and a little practice.



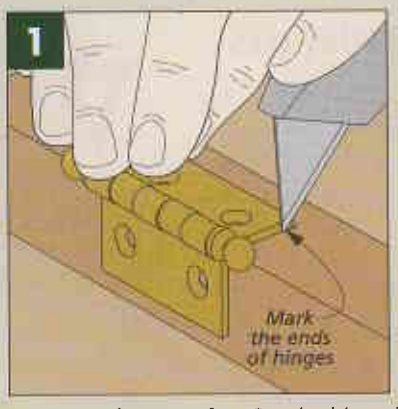


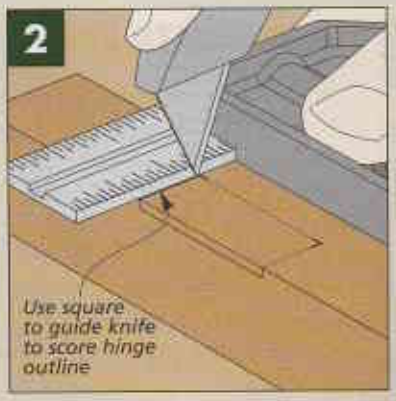
Creating hinge mortises is a job I usually reserve for the router. With a router and a simple jig, I can create perfectly sized, flat-bottomed mortises nearly every time. So why would you want to bother cutting them by hand? Well, there are a couple of reasons to consider.

If you're building a small project with small hinges, a router may be too cumbersome. And if you're trying to rout mortises in a project that's already assembled, you may not be able to get the router where you want to mount the hinges.

In these cases, creating the hinge mortises by hand may be your best (or only) option. And the truth is, with just a little practice, you can chisel a mortise in about the same time it would take you to drag out a router and set up a jig.

HINGE POSITION. Before you start making the mortises you'll need to decide how deep you want to make them. This will depend on the type of hinge you're using and how much space you want between the two hinged parts of your project. Most butt hinges have a space between the leaves to create a clearance gap between the two pieces (top drawing at left). The deeper you make the mortises,





Lay Out the Mortise. *Set the hinge in place to make tick marks for the ends and edge of the hinge. Then go back and score the outline of the hinge using a combination square to guide the marking knife.*

the narrower the gap becomes. But some hinges don't have any space between the leaves (middle drawing on opposite page).

In this case, you may actually need to make the mortise shallower than the hinge leaf to create a gap, as shown in the lower drawing. If I'm installing hinges on a door, I usually shoot for a gap between 1/16" to 1/8" between the door and the frame.

LAYING OUT THE MORTISE. Once you've determined the depth of the mortise, the next step is to lay out the mortise on your workpieces. Instead of a rule or tape measure, I like to use the hinge itself to mark out the size of the mortise.

To do this, I place the hinge where I want it and then make tick marks to determine the ends and edge of the hinge, as in Fig. 1. Then I'll use a square and a sharp knife to mark out the outline of the mortise, as you can see in Fig. 2.

REMOVING THE WASTE. With the mortise laid out, the next step is to start removing the waste. To do this, I take a sharp chisel that's just a bit wider than the mortise. Holding the chisel nearly vertical, and with the bevel facing down, I make a series of shallow, angled cuts, starting at one end of the mortise and working toward the other. You can see this in Fig. 3 below.

There are a couple of things to be aware of. First, you want to stay just shy of your layout lines when making these cuts. And second, make these cuts fairly shallow.

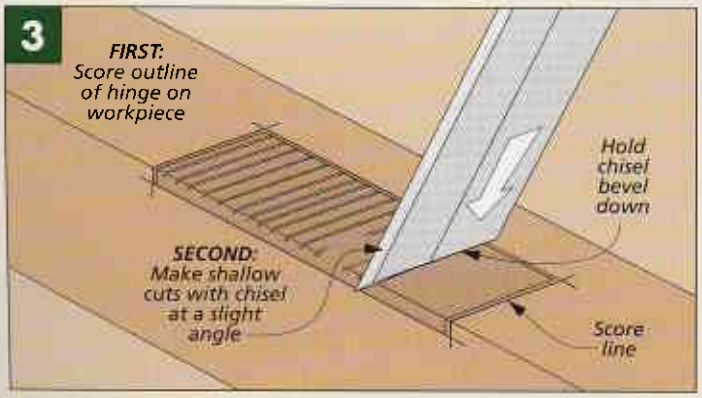
After making the first row of cuts, go back and make a second series of cuts that overlap the first, but this time with the chisel angled in the opposite direction, as shown in Fig. 4. What you're doing here is breaking up the waste by making a series of V-shaped cuts.

CLEANING UP THE MORTISE. The next step is to pare away the waste. Here is where you need to use a little finesse. Working your way in from the side, carefully slice away the chips that you created by making the V-shaped cuts. You can see what I mean in Fig. 5. The key is to trim the material a little at a time.

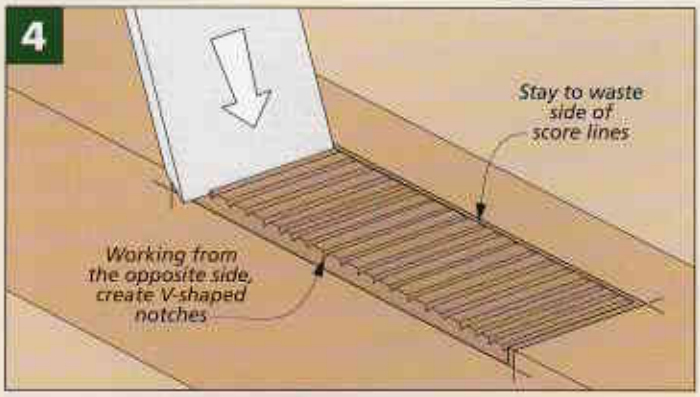
Next, you'll repeat this process until you reach the final depth. The final light strokes should smooth out the bottom of the mortise.

SQUARING THE MORTISE. Once you've finished removing the waste, the final step is to square the ends and side of the mortise. At this point, there isn't much material left to remove, so you should be able to pare it away cleanly with very little effort, just as you see in Fig. 6. It's a good idea to test the fit of the mortise with the hinge as you go along to see where you may need to trim away more material.

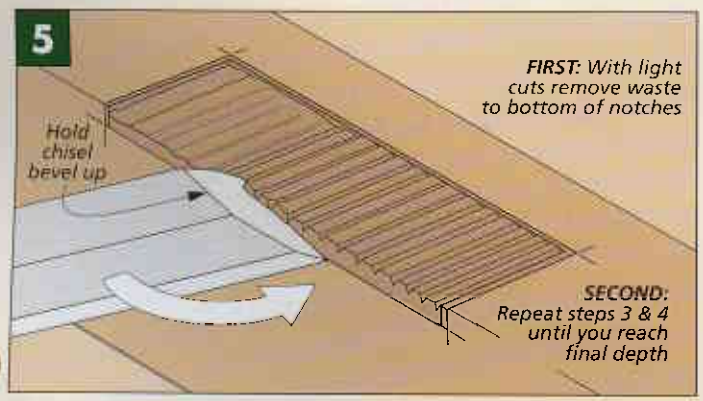
Finally, once you're satisfied with the fit, you can slip the hinge in place and drive the screws in. W



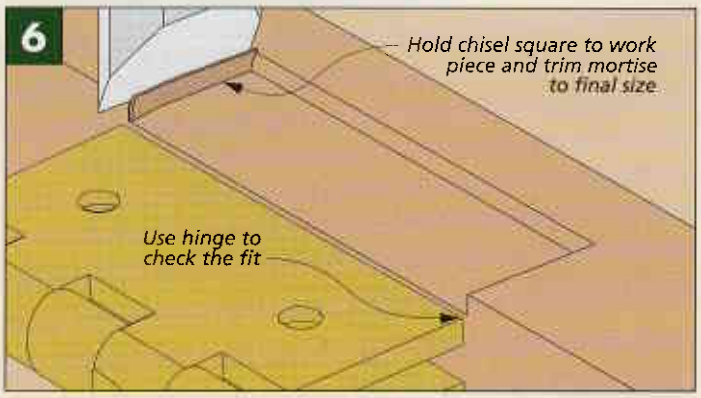
First Cuts. *After scoring the outline of the hinge, take a wide chisel and make a series of cuts. Stay to the inside of the layout lines and be sure not to cut deeper than the mortise depth.*



Now, the Opposite Way. *From the other direction, make another set of cuts with the chisel to create a series of shallow V-shaped cuts. This helps loosen and break up the waste.*



Pare Away the Waste. *Holding the chisel flat, with the bevel up, slice away the loosened waste. Work across the mortise in several, light passes to avoid going too deep.*



Square the Corners. *The final step is to clean up the mortise. Here, you'll square the corners and trim the edge and ends for a snug fit. Use the hinge to check your progress.*

looking inside
Final Details

▲ *Tilt-Out Storage Chest.* With easy access to the tilt-out bin of this storage chest, you'll have no trouble keeping shoes, purses, books, and more stored and organized. Detailed plans begin on page 20.

▲ *Serving Tray.* Building this handy tray won't take a whole lot of time or materials. Plus, you'll be able to customize it to a look and style you like. Find out how it's all done starting on page 16.

▲ *Grandfather Clock.* This Craftsman-style clock is sure to be a family heirloom for generations to come. By adding an optional quartz movement and glass shelves, you can change it to a unique display case that also keeps time. You'll find detailed, step-by-step instructions on page 30.